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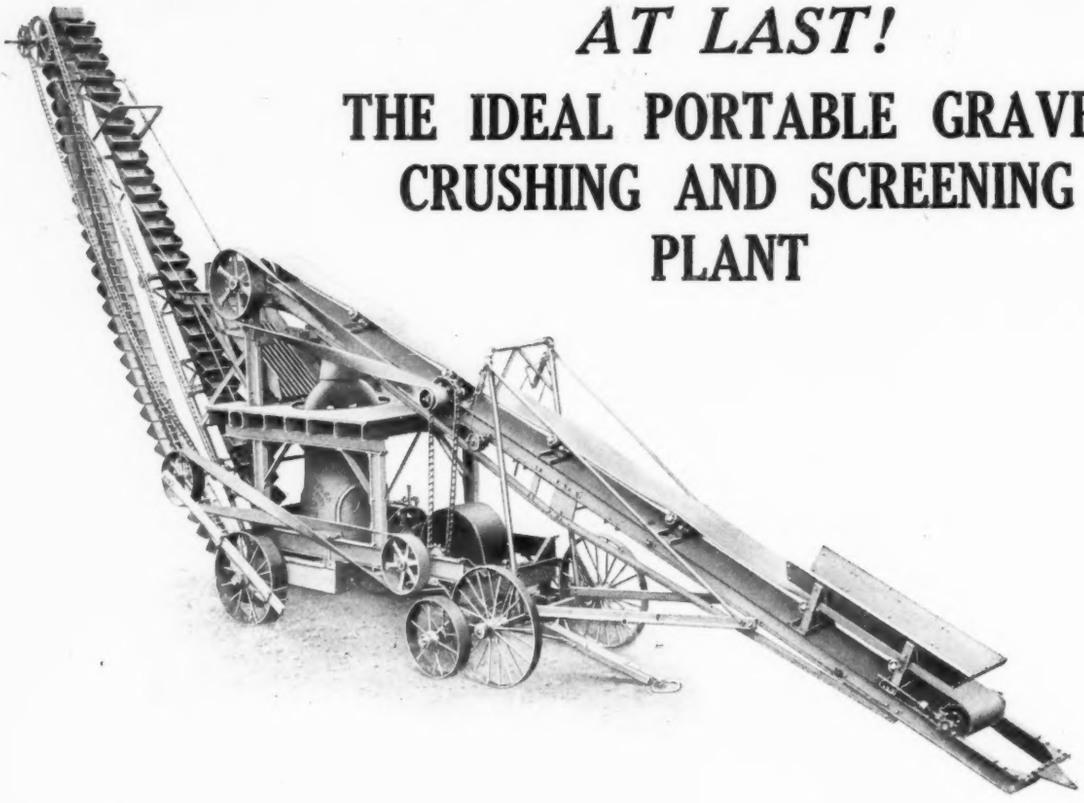

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VOL. 55 NO. 2

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Vol. 55 February, 1924 No. 2

Sidewalk and Curb Details

Relation of radius of curb intersections and location of sidewalk pavement to convenience and congestion of traffic. Opinions of a number of city engineers and practices in more than four hundred cities.

Among the many features, some far-reaching and some of only minor importance, which have been affected by the rapid increase of automobile traffic, is the radius of the curves at street curb intersections. With horse-drawn vehicles having short wheel base and moving slowly, it was practicable to turn a comparatively short corner, and right-angle corners or those with radii of only 2 or 3 feet were common practice.

With automobiles traveling at several times the speed formerly common in city streets and with much longer wheel base, a longer radius became desirable both for convenience to the driver of the automobile and also because, with a sharp corner, it was necessary for him to swing well out into the roadway both in approaching and leaving the curb intersection, thus interfering with traffic and practically narrowing the effective width of the pavement at the intersection.

This subject seemed to us of sufficient importance to warrant including, in our recent questionnaire on street work, questions concerning the radius adopted by cities for new construction at curb intersections and, incidental thereto, what cities were making a practice of reconstructing old corners to longer radii.

LOCATION OF SIDEWALK PAVEMENT

Another feature of road design indirectly connected with this is the location of the paved portion of the sidewalk. Some cities have in the past considered it desirable practice to locate the pavement immediately adjacent to the curb. This, of course, is done by most in the business sections, where the pavement extends entirely from curb to building line. In the residence sections, however, where the sidewalk space is generally considerably wider than the paved portion of it, the more common practice is to place parking, consisting of sod with or without trees, between the curb and the pavement.

Placing sidewalk adjacent to curb has, as one advantage, that persons alighting from automobiles can step directly onto the sidewalk pavement rather than onto the parking strip, the grass of which may be wet or muddy, and it does away with the narrow unpaved strip between pavement and curb which is frequently neglected by the adjacent property owners and, when so neglected, is an eyesore. On the other hand, sidewalk pavement next to the curb greatly increases the possibility of pedestrians being splashed by mud or water from passing vehicles

STREET IN ANN ARBOR, MICH., SHOWING SIDEWALK WITH AND WITHOUT PARKING STRIP NEXT TO CURB.

and, in the opinion of many, such location is less pleasant than one where the walk is bordered on each side with sod and possibly trees. With the introduction of long radii at the curb corners, this location developed another serious disadvantage, in that it required the pedestrian to step off into the street at a point where the curb made a sharp angle with the line of the sidewalk, and increased considerably the distance which he was required to walk in the roadway subjected to the dangers of traffic.

The questionnaire revealed that very few cities now place sidewalk pavement next to the curb, although a few state that this has been practiced more or less in their cities in the past. Among these is Circleville, Ohio. The city engineer of that city explains conditions and present practices in that city as follows:

The question of where to locate sidewalk pavements is generally answered with reference to the conditions to be met. In new layouts, a street width can be selected which will permit of location wherever desired. If the space is available, it is more pleasing and attractive to have a generous grass plot for trees and shrubbery between the curb and the sidewalk pavement. This relieves the monotony of so much pavement in a continuous stretch as is the case when the pavement is next to the curb. The latter, however, offers the convenience of being able to drive up to the curb at any point and alight on a solid pavement instead of a wet and perhaps muddy grass plot.

The principal reason the writer sees for locating sidewalk pavements next to the curb, however, is to improve old streets where the trees are already grown and the houses built. One of the accompanying illustrations shows a street so treated. This street is 66 feet between property lines and before it was paved some of the buildings shown in the illustration had been built at the property line and had steps projecting out to the sidewalk pavement, which formed an obstruction to pedestrian traffic. When this street was paved, the width between curbs was made 30 feet. As the distance between the lines of trees on either side of the street was 46 feet, this left a strip about 8 feet wide on each side between the new curb line and the trees. Under this condition a 5-foot sidewalk pavement was laid adjacent to the curb leaving a space of 3 feet between the pavement and the trees. This gave 13 feet additional lawn to the property facing the street and removed the sidewalk paving from immediately in front of the houses, which was a great improvement.

Where a street is narrow, say 50 feet between property lines, with a minimum width of street pavement of 30 feet there will be 10 feet available for each sidewalk. In this case, using a 6-foot sidewalk pavement there would be only 4 feet left for a grass plot, which would be insufficient if it were desired to plant trees therein. In the other of the illustrations herewith, the trees fully occupy the grass plot which is 7 feet wide, and any narrower plot would result in the curbs being pushed out of line and the pavement raised by the growth of the roots. For this reason, in the case just cited, it would be better to place the sidewalk pavement next to the curb and place the trees near the property line where they would have room to grow without causing any damage to the pavement; it being assumed, of course, that the houses would be built some distance back from the property line.

NARROW SIDEWALKS WITH PARKING STRIP, CHARLESTON, S. C.

Another city where some of the sidewalks are adjacent to the curbs is Freeland, Pennsylvania. The borough engineer of Freeland, Theodore Reichmann, states that in the original laying-out of the city the streets were narrow and only 5 or 6 feet was left for sidewalks, under which condition all or practically all of the space was necessarily paved.

In Nazareth, Pennsylvania, it is optional with the property owner to build the pavement from the building-line to the curb, place a narrower pavement next to the curb, or introduce a sodded strip between the curb and the pavement; but the method adopted must be carried out continuously for the length of any one street, so that uniformity is obtained.

Under certain topographical conditions there may be special reasons for placing the sidewalk next to the curb. For instance, on side hills where the property on the upper side of the street is much higher than the sidewalk, to move the sidewalk pavement back from the curb would increase the amount of excavation necessary and also increase the height of the terrace or retaining wall between the pavement and the lawns in front of the houses. A condition of unusual topography is reported by A. J. Kerr, town engineer of Clifton, Arizona, who states that Clifton is built in narrow canyons and good building sites are scarce, for which reason only 30 feet is left between building lines for both roadway and sidewalk. Under this condition the width left for sidewalk space was extremely limited and was all paved.

SIDEWALK ALONG CURB. PARKING STRIP ALONG CURB.
STREETS IN CIRCLEVILLE, OHIO.

PARKING STRIP COMBINED WITH RETAININGI WALL, WHICH IS BUILT AT PROPERTY LINE.

One of the objectionable features of paving next to the curb is the difficulty of carrying driveways for entrance to garages from the roadway into the property, this generally requiring a depression in the sidewalk which is inconvenient for pedestrians. In Clifton such depressions are left in the sidewalk or, in some cases, a 10-inch pipe culvert is placed just outside the curb and the driveway carried over it, but Mr. Kerr states that this obstructs the street and is very unsatisfactory. In fact, neither of the arrangements is at all satisfactory.

WIDTH OF SIDEWALK PAVEMENTS

The widths of paved walks, as shown by the statistics on pages 72 to 74, have been summarized, with the following results: Sidewalk pavements not more than 5 feet wide are found on the residence streets of 302 cities and the business streets of 8 cities. Maximum widths of pavement of more than 5 feet but not more than 10 feet were found on the residence streets of 165 cities and the business streets of 119 cities. Maximum width of paving of more than 10 feet were found on residence streets in 11 cities and on business streets in 395 cities.

An interesting detail of street designing was reported from Illinois. We noticed that several cities in that state and some in other states reported a sidewalk width of 5 ft. 4 in. Inquiry brought reply from Lawrence W. Cox, city manager of Maywood, Ill., that this odd width was probably due to the fact that the sidewalk pavements were originally built of boards laid crosswise, and one 16-foot board could be cut into three lengths each 5 ft. 4 in.

Of those cities reporting the location of the sidewalk pavement, where it was not adjacent to the curb, eighty-four stated that it was placed against the property line; one city 10 inches from the property line; thirty located 1 foot from the property line; one city from 1 to 4 feet; one from 8 inches to 18 inches; six cities 18 inches; twenty cities 2 feet; two cities 2½ feet; one 2 to 3 feet; one 2 to 5 feet; one 3 feet; five 4 feet; two 5 feet; one 5 to 6 feet; one 8 feet, and one 9 feet.

RADII AT CURB INTERSECTIONS

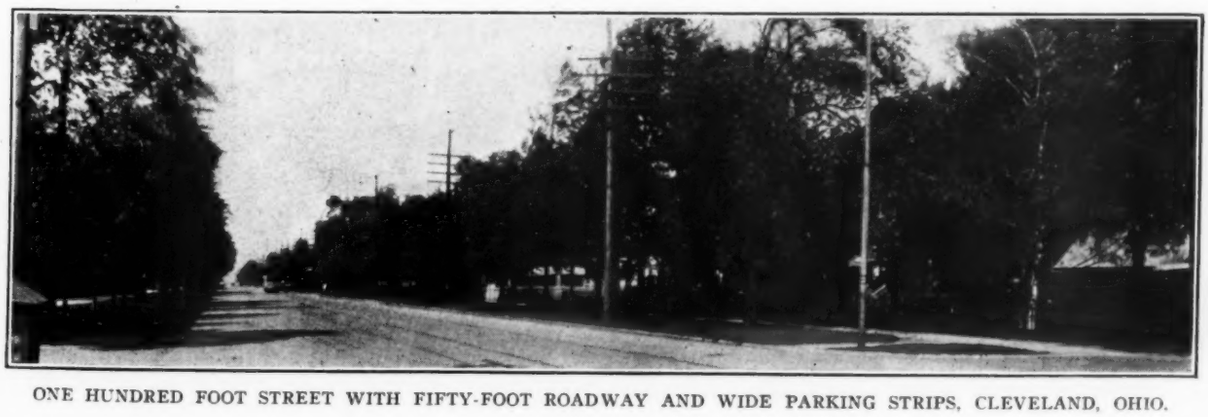
In the matter of radii at curb intersections, there is much more variety of practice. The table compiled from information received from about 450 cities shows radii of all lengths from 1 foot up to 100 feet. Over half of these cities report that the present practice is to use radii greater than 10 feet but not greater than 20 feet. Only 7% report radii greater than 20 feet, while 36% report the use of no radii greater than 10 feet.

Over 60% of the cities report that they are more or less rapidly changing existing curves with short radii to those of longer ones, generally in connection with repaving or other reconstruction of the street. About 32% report that they are not making any changes in radii of old curb corners; 3% of these, however, expect to do so.

A number of the engineers who reported using radii greater than 20 feet were asked to explain the conditions under which these longer radii were used, and a few of the replies are given below:

William L. Theisner, city engineer of Salina, Kansas, states concerning practice in that city:

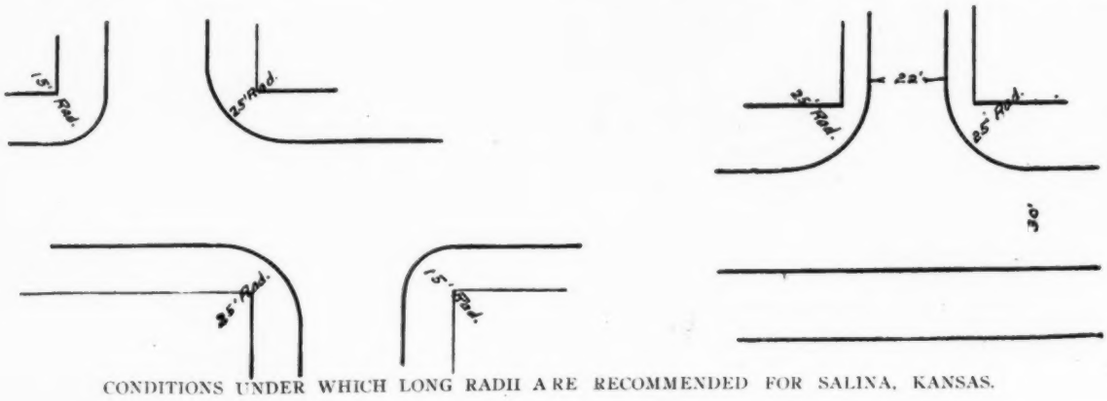
> Radii greater than 20 feet are used only in exceptional cases, the radius for all new work being 15 feet; the longer radii being used only in the residence sections where pedestrian traffic is at a minimum, and only then to eliminate a dangerous turn where there is a jog in the street intersection or where turning onto a narrow paved street.
>
> The accompanying two sketches indicate the only two conditions under which I would advise using radii greater than 20 feet. From these you can readily see



ONE HUNDRED FOOT STREET WITH FIFTY-FOOT ROADWAY AND WIDE PARKING STRIPS, CLEVELAND, OHIO.

that with a large radus as shown, it is much easier to keep to the right side of the street and not interfere with passing traffic.

The acting city engineer of Newton, Massachusetts, William P. Morse, states:



CONDITIONS UNDER WHICH LONG RADII ARE RECOMMENDED FOR SALINA, KANSAS.

Before automobiles came into use, all our street corners were rounded practically with 12-foot radius on the street line, making the curb radius 20 feet (the sidewalk width being 8 feet). Since the advent of automobiles this does not give room enough to navigate easily around corners with large cars and the present length of 23 feet radii for curb corners seems to give general satisfaction, the street or property line corners being rounded with a radius of 15 feet. Corner buildings have to conform to this curved property line.

The director of Public Works of Durham, North Carolina, H. W. Kueffner, explains the practice in that city as follows:

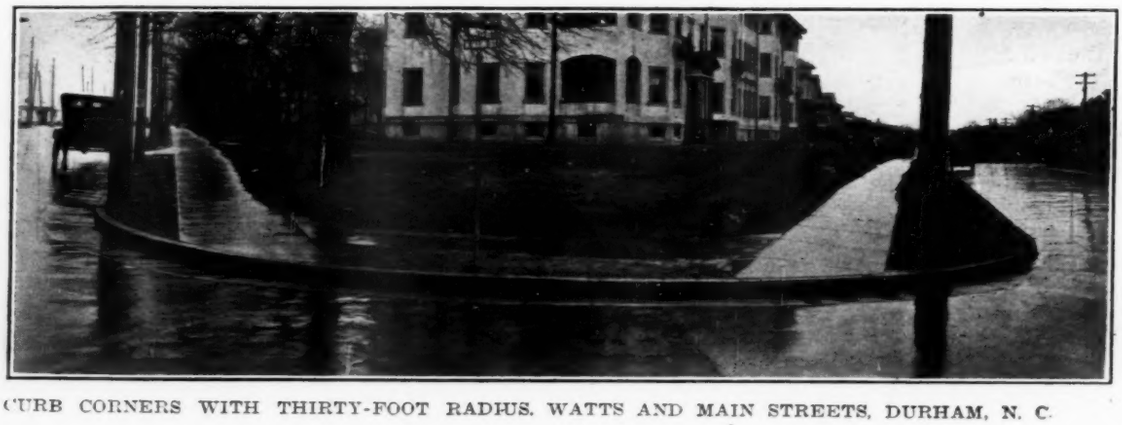
We believe that in residential sections, where the street widths between curb lines are from 30 to 40 feet and the parking and sidewalk strips are from 15 to 25 feet, a radius of from 15 to 30 feet can be used. Of course these radii apply to right-angle corners. In the business sections the writer does not think that long-radius curves are desirable for two reasons: first, that it allows traffic to go from one street into another at a rate of speed greater than safety to pedestrians or traffic would allow; second, it increases the distance that pedestrians have to travel to get across a busy street. On right-angle corners in the business section we use from 6 to 10 feet radius, depending on the width of the sidewalk. In the residential section we have adopted the following as a limit for the radius of a corner curb—the radius is never made more than would allow the full width of a 5-foot concrete walk around the corner outside of the property line, we having established the rule of laying a sidewalk next to the property line.

The city engineer of Sharon, Pennsylvania, Lewis E. Burnside, writes:

Our usual practice is to make radii of curb corners the same as distance from property line to face of curb, and in a majority of cases this gives a radius varying from 10 to 15 feet. We are not making any radius on new construction less than 10 feet and where it is at all possible without cutting back on the sidewalk crossing to an extent that would make the crossings inconvenient, we make the radius 15 feet.

Curb corners of 20 and 25 feet radius were incorporated during the past year on the intersections of a sheet-asphalt pavement on a residential street running through a high-class residential section of the city. This street has a pavement 34 feet wide and is intersected by cross streets having pavements 26 and 27 feet wide. It is expected that there will be very little pedestrian traffic on this street, but there will be a considerable amount of automobile traffic. For these reasons it was decided that a large radius for curb corners would be best suited for the general needs of the street. It is true that there would be some disadvantage to the pedestrians in connection with the long radius; however, we believe that in view of the conditions existing and to be expected on this street, the vehicle traffic should be given preference over pedestrian traffic. The large radius used on this street will increase the distance pedestrians have to walk in the roadway by about 6 feet, which we believe will not prove a serious matter.

The Planning Commission of this city is now and has for some years been requiring that all lot subdivisions or other proposed layout of streets be so designed that a curb radius of 25 feet can be installed. In the case of a wide street, this, of course, is easily provided, but in the case of a street having a width of 60 feet or less, it is necessary to curve the lot corners adjacent, in place of the usual square lot corner. The installation of the 20-foot and 25-foot radius in these streets will be watched and studied with considerable detail by this department to observe its effect on both vehicle and pedestrian traffic and from that study it will be determined whether the practice of long radii will be continued or not. As yet there has been very little building on this street and consequently a very small amount of pedestrian traffic,



CURB CORNERS WITH THIRTY-FOOT RADIUS, WATTS AND MAIN STREETS, DURHAM, N. C.

but residential building here will be increased largely within the next year or two and then observation of pedestrian traffic will be more definite.

In Chambersburg, Pennsylvania, the standard radius for curb corners is 6 feet, but we are informed by F. T. Rhodes, Jr., borough engineer, that a radius of 40 feet was used on Main street, at four right-angle turns in the street near the edge of the town.

May & Smith, engineers of Patchogue, Long Island, state that where they are laying out streets in rural or semi-rural districts and find turns approximating 90-degrees, they endeavor to have the town officials procure from the owners of land adjoining these corners the donation of sufficient land to enable them to cut the corners so as to introduce long swinging curves. Even in these cases they do not bring the roadway pavement inside the established curb line, but do bring it in some cases so far in as to make it tangent to the established curb line.

Reference was made above to the use of the distance from property line to curb line as the radius of the curve at curb intersection. This practice was reported from quite a number of cities, and we judge from the replies that in many cases where the length of radius was stated, this length was the distance between property line and curb.

Several report using different radii at alley intersections from those at street intersections. Washington, Indiana, uses 6 feet at street intersections and 2 feet at alley intersections; LeMars, Iowa, 12 feet at streets and 6 feet at alleys; Muscatine, Iowa, 16 feet at streets and 6 feet at alleys; Norfolk, Nebraska, 12 feet at streets and 4 feet at alleys; Altoona, Pennsylvania, 10 feet at streets and 6 feet at alleys; Slatington, Pennsylvania, 8 feet at streets and 4 feet at alleys.

Paris, Texas, and Worcester, Mass., use the width of the narrower of two intersecting sidewalks; Sheridan, Wyoming, 10 feet in business and 5 feet in residence districts. Decorah, Iowa, which uses 16 to 25-feet, uses the longer radii on the narrower streets. Iron River, Michigan, uses 15-foot radius where the streets are 30 feet wide or over and 25-foot radius where they are less than 30 feet. Hibbing, Minnesota, uses 12 feet in the business section and 18 feet in the residence; St. Cloud, Minnesota, 3 feet to 6 feet in the business and 9 feet to 12 feet in the residence section; Havre, Montana, 5½ feet in the business and 10½ in the residence section; Fairbury, Nebraska, 9 feet in the business and 12 feet in the residence sections.

Reasons have been advanced by one of the engineers quoted above for making the radius shorter in the business than in the residence districts. Another reason why it would seem to be unnecessary to use long radii in the business district is that in such district cars are ordinarily parked along the curb up to within 20 feet of the curb corner, and even if at any given moment no car should be parked there, the available width and use of pavement would ordinarily be the same as though this parking space were occupied. With a car parked within 20 feet of a curb intersection on each of two intersecting streets and allowing 8 feet of roadway for width of the parked car and clearance, the flatest circular curve that a vehicle could take in rounding the corner would be one of 27 feet radius, and this would clear the curb corner even if the curbs intersected at right angles. Considering this together with the fact that speed in rounding corners is to be discouraged in the business district, the length of radius of curb intersections would seem to be of little moment in a business district where parking is allowed, at least insofar as it affects congestion of traffic.

Pennsylvania's New Road Specifications

The Department of Highways of Pennsylvania has just adopted changes in its specifications for concrete roads. The previous specifications called for an 18-foot concrete slab 6 inches thick at the center and gradually increasing to 8 inches at the sides, with reinforcement across the entire width. The new design calls for two slabs, divided by a longitudinal joint, 6 inches thick at the center of the road and to within two feet of the edge, and from there increasing to 9 inches at the edges. Longitudinal reinforcing bars will be placed along the edges, both at the center and at the sides. On heavy-duty roads, slabs will be used 7 inches thick at the center and 10 inches at the sides. On secondary roads the slabs will be 5 inches thick at the center and 8 inches at the sides. The state calculates that the saving on steel, concrete and labor on the 2,800 miles of roadway to be built during the next three years will approximate $10,000,000. It is expected that the longitudinal joint will practically eliminate longitudinal cracking of slabs now so generally experienced.

William H. Connell, engineering executive of the Department, states that the determination of this type was based on the results of the studies made in connection with the Bates test road and the experimental road in Pittsburgh, California, and investigations conducted last year by the Pennsylvania Highway Department.

Gas in Manholes

The atmospheres in manholes connected with telephone conduits in Philadelphia have been inspected by the Department of the Interior, acting through the Bureau of Mines, to learn whether carbon monoxide were present. The hoolamite detector and a newly devised bomb tester for explosive gases were used. The bomb was made of pipe fittings, spark plug, automobile spark coil and dry cells. Of thirteen manholes in different parts of the city suspected of being gaseous, twelve contained irrespirable atmospheres and two of them were explosive. Eleven holes were tested at random and eight showed dangerous quantities of carbon monoxide. Workmen in Philadelphia ventilate gaseous manholes before entering, using sails or a rotary hand-driven blower similar to a blacksmith's forge blower.

Traffic and City Streets

The engineer's responsibility in solving the problem of congestion of city streets. Some suggested solutions.

"The traffic relief problem has heretofore been regarded as one in which the Police Department was primarily concerned, but it would seem that it has now assumed such proportions that the engineering service must take the lead in providing a solution. The recognition of this responsibility by the profession should bring about the freeing of the streets to the traffic needs of today and the days to come."

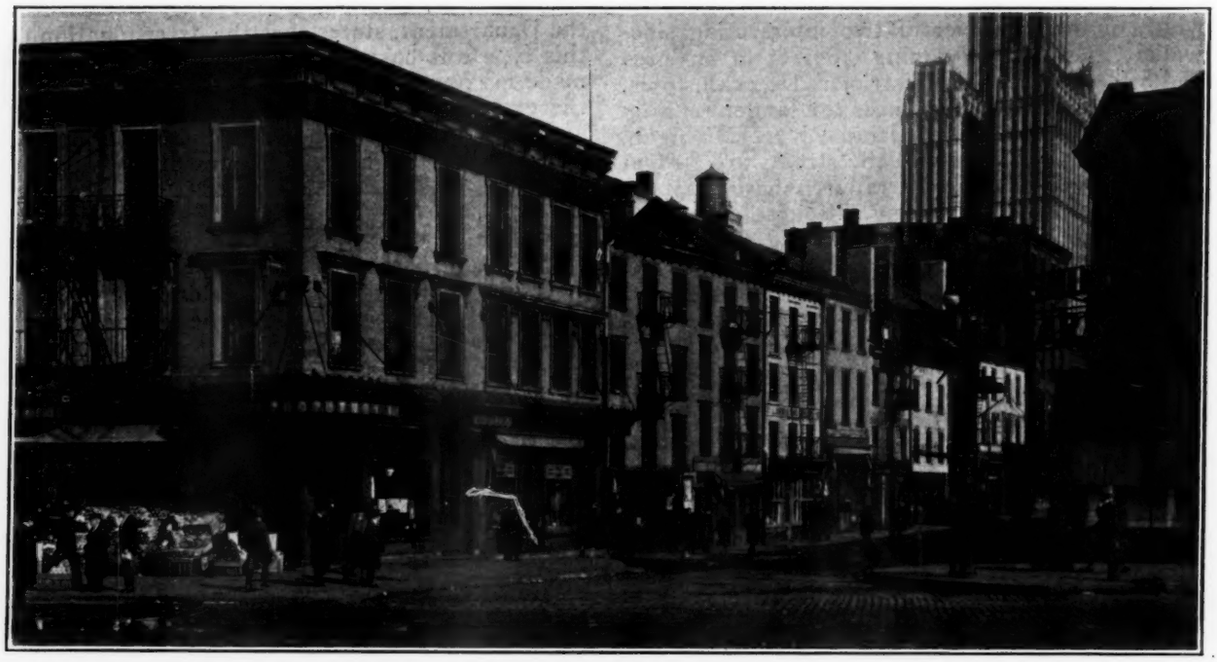
In these words, Arthur S. Tuttle, chief engineer of the Board of Estimate and Apportionment of New York City, in a paper before the City Planning Section of the American Society of Civil Engineers, last month called the attention of all engineers and other officials who are concerned with the designing, constructing and maintaining of city streets, to the importance to them of the traffic problem. Traffic *control* has developed to the point where the facilities offered by streets as now constructed have been utilized to almost their limit in many cities; further growth of traffic, which is certain to come, must be met by changes in the streets themselves. And where new streets are being designed or hard pavements laid on old ones, it may often be true economy to introduce new features now or provide for their adoption at moderate cost when they may in the future be needed.

In Mr. Tuttle's paper above referred to, he states that "15 per cent. represents a conservative estimate of the present annual increase in traffic in the congested sections." And others have estimated this to be 20 per cent. in other cities. In other words, the traffic is doubling in four or five years.

In most cities the problem of parking automobiles is even more troublesome than that of moving traffic. The fact that one or two passengers in an automobile occupy an area of say 9 by 50 feet of roadway is partly offset by the speed of the vehicle; but when parked, we have an area removed from traffic use of about 8 by 15 feet per car or 60 sq. ft. per capita, assuming an average of two passengers to a car. Probably no city feels that its present treatment of the parking problem is more than a temporary and unsatisfactory makeshift.

In his discussion of the subject, Mr. Tuttle considers seven expedients for providing relief to traffic. One, the constructing of new streets in the business district by demolishing buildings, he believes to be impracticably expensive (about $25,000,000 a mile of street in New York). The other six are:

1. Requiring new buildings to set back to lines proposed for ultimately widening a street.
2. Widening of roadways.
3. More drastic traffic regulations.
4. Removal of roadway encroachments.
5. By-passing of traffic.
6. Introduction of arcades.



NORTH-EAST CORNER OF VESEY AND WEST STREETS AS IT WAS (ON SUNDAY)

Set-back ordinances have been declared unconstitutional in New York and he believes that they will ultimately be found so in all states, except for areas where development has not progressed far.

Widening roadways seems much more practicable in many cases. Streets in New York 60 ft. wide with 30 ft. roadways and 15 ft. sidewalks are being changed to 34 ft. roadways. (Quite a common practice in the past in other cities, it appears from answers to our questionnaires, has been making each sidewalk one-fifth the street width, or 12 ft. on a 60 ft. street, leaving a 36 ft. roadway.) A 34 ft. roadway permits two 9 ft. lanes of moving traffic, with 8 ft. for parking along each curb. But where large trucks park and travel, even 36 ft. will not permit this. Where the roadway is less than 34 ft. and parking along both curbs is necessary, establishing it as a one-way street seems to be the only solution.

Sidewalks at present are seldom as crowded as roadways and could often be narrowed; but, allowing 9 ft. width for a traffic lane, it appears that 4½ ft. must be taken from each sidewalk to provide one additional lane and less than this would be of little use. In future planning, however, of business streets, less sidewalk width would seem to be necessary than has often been allowed in the past, and more roadway width.

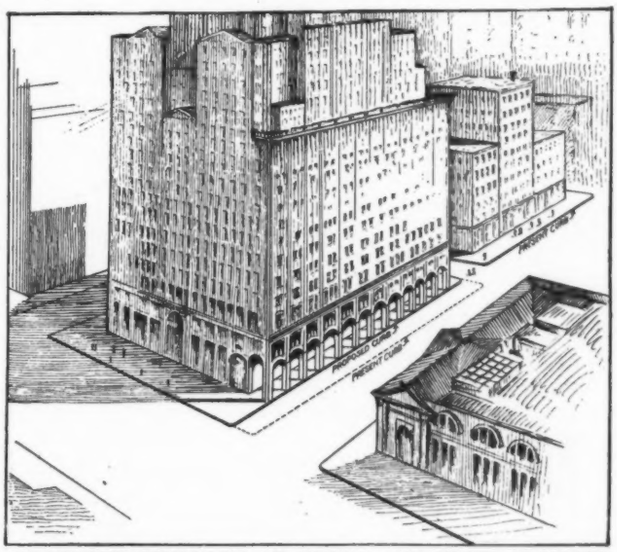
Traffic regulation (3) would seem to be a matter for the police rather than the engineer, and the same is true of some roadway encroachments (4). Other encroachments, however, are of engineering origin, such as elevated road columns and street car tracks in the roadways, and poles, hydrants and building projections on the sidewalks. Street cars in a crowded street add greatly to the congestion and little to the solution of the passenger transportation problem.

By-passing traffic (5) may be accomplished both by using existing streets and by opening up new ones in outlying sections. Diverting traffic to existing streets can often be encouraged by making their roadways smoother, wider or otherwise more attractive. This work of the engineer should, of course, be supplemented by traffic laws and police action requiring traffic to use the improved streets.

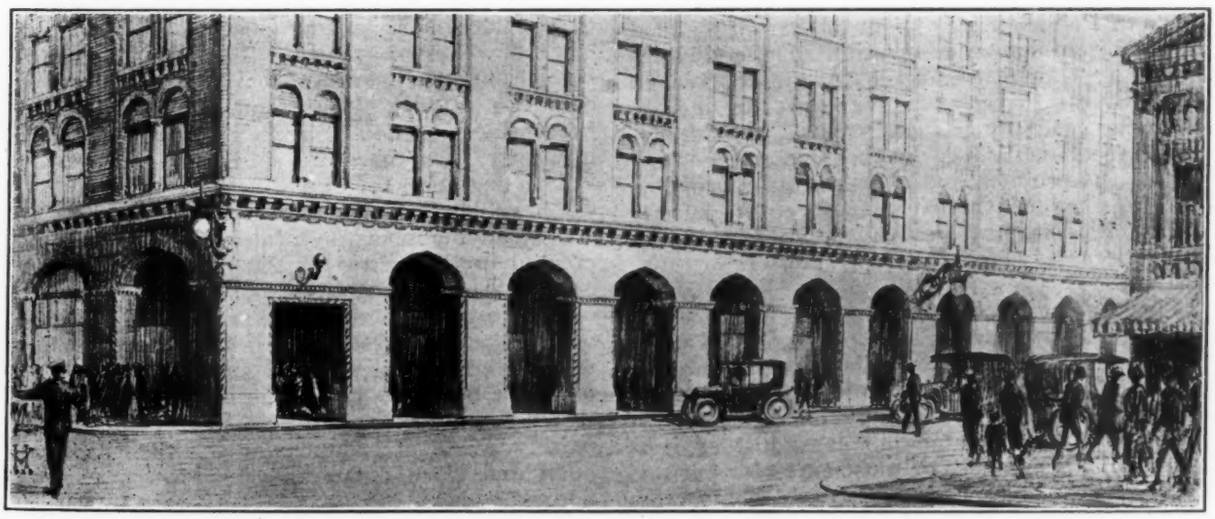
Other methods of increasing traffic space in the streets are considered by Mr. Tuttle, such as double-decking them. This he finds undesirable because it would depreciate property value both by cutting off light from the ground floor and also by reducing this floor to the condition of a basement when the foot traffic is carried on a level with the second floor. However, Chicago city planners consider this more favorably, both elevated sidewalks and sidewalk subways being under consideration.

ARCADED SIDEWALKS

He seems to find special promise in the use of arcaded sidewalks, which he defines as a measure between that of double-decking the street and of widening the entire street. Such arcades are quite common in Europe, but only one is found in this country to his knowledge, that being 15th Street, Philadelphia, between Market Street and South Penn Square, where a sidewalk 19 feet wide extending 18 feet under the buildings was



PROPOSED BUILDING AT VESEY AND WEST STREETS. ARCADED SIDEWALK PERMITS WIDER ROADWAY.



PROPOSED ARCADE AT NORTHEAST CORNER OF VESEY AND WEST STREETS.

constructed on the east side. An arcade proposed for Vesey Street at the corner of West Street, New York, is shown in the accompanying illustrations of the New York Telephone Company's new building whch is now under construction. Vesey Street is 56 feet wide and, in planning its building, the Telephone Company offered to give the city sidewalk privileges for a width of 20 feet.

The arcade does not seem to have detracted from the business advantages of the property in any case where used and even may have added to its value. "The type of skeleton frame building now in common use for office and commercial purposes lends itself admirably to the arcade proposition, and with an effort to adapt the arcade plan to each it would seem that in a large percentage of the buildings where the arcade principle might be justified, its introduction should not occasion a large cost for the rights required." Some difficulty presents itself in drawing up a title deed to the city which will enable it to construct and own a sidewalk on the ground level without at the same time depriving the owner of the rights to his property above and below this level; but it is hardly probable that this cannot be solved in some way if the legislators and lawyers apply themselves to the solution.

In discussing Mr. Tuttle's paper, Harvey W. Corbett, a New York architect connected with the Sage Foundation, suggested segregating foot, wheel and rail traffic in three different levels, rail traffic underground, wheel traffic on the surface, and foot traffic on second-story streets. Harland Bartholomew, of St. Louis, however, considered such a plan to be applicable only to New York City. Mr. Bartholomew also called attention to the fact that a considerable amount of traffic control would merely result in adding to the traffic; in other words, as much traffic would use the present congested thoroughfares as could be gotten into them. He thought more promise lay in excluding from such thoroughfares those classes of automobiles which could equally well use other streets. Jacob Crane, Jr., of Chicago, and C. D. Hill, of the Board of Public Improvement of that city, added to the discussion a description of the double-deck street which carries Michigan Avenue across Chicago river and gave figures to demonstrate the economy of such streets. The double-deck street is a very expensive method of solving the problem, but it seems quite probable that in some of the congested centers of the larger cities it may yet be adopted as one of those necessary for relieving intolerable congestion.

The parking problem, already referred to, is being found by many cities to be an even more troublesome one than providing for the moving traffic. Theoretically, it would seem to be improper to permit private individuals to obstruct the roadways with standing cars, just as it is against the ordinances of most cities for persons to congregate on the sidewalks to the obstruction of pedestrians. However, the question is, if automobiles are not to be allowed to park in the street, what will they do Any city official who tried to enforce an ordinance making it illegal for an automobile to stand for more than, say, five minutes along a curb would find himself instantly unpopular, to say the least, and with a real job on his hands.

Downtown parking may be provided for by (1) parking basements in office buildings; (2) parking garages; (3) open lots; (4) public parks.

In Los Angeles, in the Pacific Mutual Building, the two lower floors, each 60 x 350 feet, are devoted to parking and accommodate 140 cars, charging $17.50 to $20 a month for each car. The new Investment Building, now being constructed in Washington, D. C., will have space for 140 cars.

Parking garages are found in several cities. One in Pittsburgh, within a few blocks of the business center, has room for 450 vehicles and makes an average charge of $20 per month. There is planned for Washington, D. C., an automobile hotel eight stories high to care for 800 automobiles. Hugh E. Young, engineer of the Chicago Plan Commission, has proposed a plan for sub-surface garages for 7,000 cars in Grant Park. For Baltimore, a municipal parking building is proposed, as described below.

Baltimore's Parking Problem

Like all other large cities—and most small ones—Baltimore has on its hands a parking problem which threatens to become a very serious one. The subject has been discussed by Charles O. Scull, chairman of the Board of the U. S. Fidelity and Guaranty Co. of that city, and some suggestions offered.

The three suggestions that seemed to him most practical were securing underground parking spaces by tunneling hilly streets; removing several blocks of buildings in the center of the city to provide open parking spaces; and building large down-town garages. The first would not furnish enough parking facilities; the second could do so only by sacrificing a large area in the business section at great cost, and would be unsightly. He therefore suggests the third.

The engineers of the Fidelity and Guaranty Co. have designed a garage that is shown by the accompanying plans, several of which would be erected in the center of the city. Each would occupy about half a city block. They would be of reinforced concrete, fire-proof and equipped with a sprinkler system. They would have electrically lighted aisles, ramps and runways, standpipes for floor washing, and floor drains. There would be no heating plant, no car washing or repairing. One attendant would direct parking, open and close doors and windows and clean floors.

The estimated cost of a site and four-story

building, housing a thousand cars, would be $800,000. "Nominal charges per day for a car would yield enough income to cover interest, operation and sinking fund and compensate for lost taxes" (assuming municipal ownership).

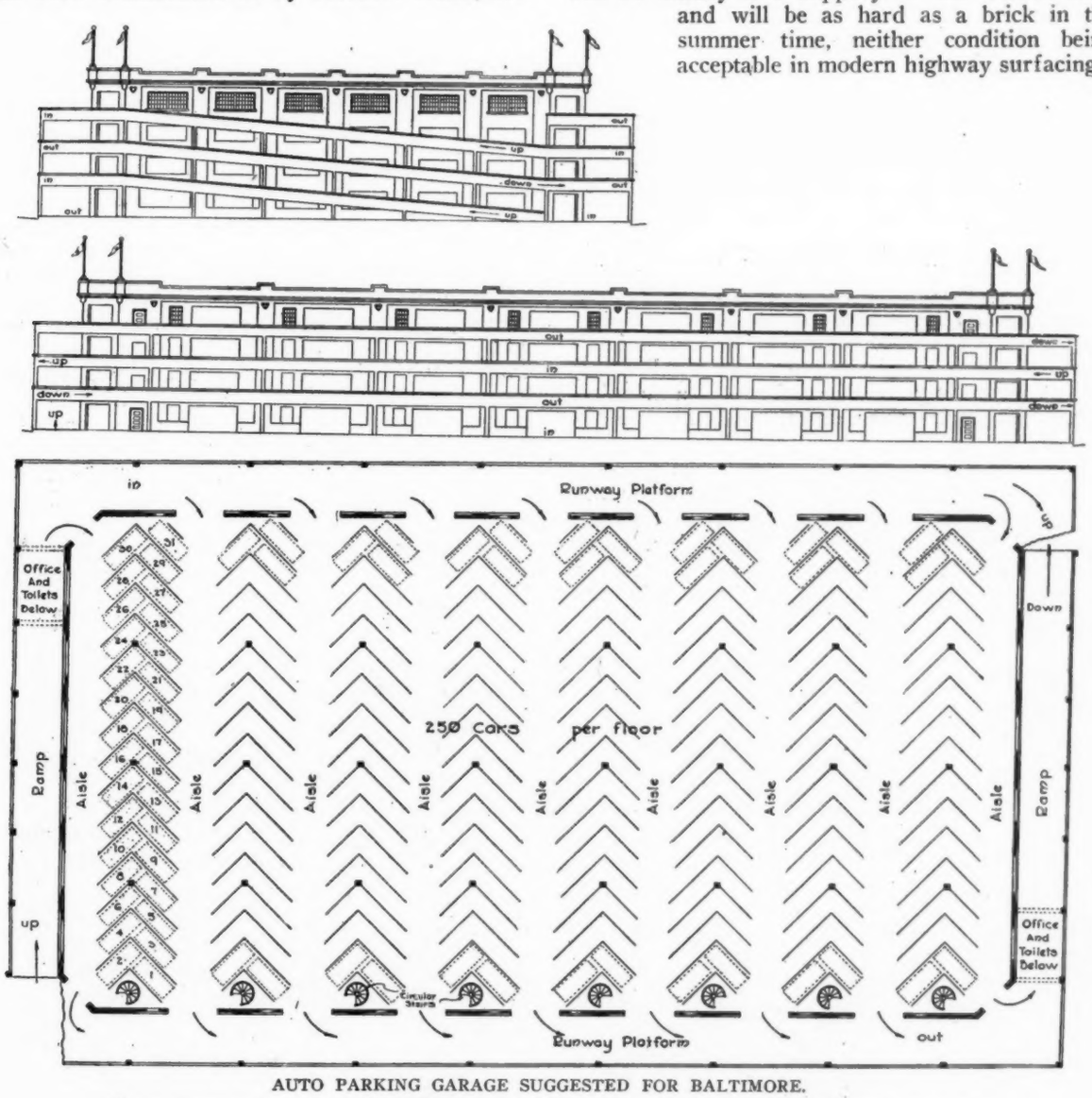
There should be two separate sets of ramps and runways, one for cars entering, the other for those leaving. The grades of the ramps would not be exceptional. Entrance to the first floor would be on the street level. (It would seem to be possible to put an additional floor below the street level.—Editor.)

Gravel Roads in Oregon

In our January issue we referred to a method employed in Nevada for constructing gravel roads without the use of water, since this was almost impossible to obtain. This description has been commented on by Herbert Nunn, formerly state highway engineer of Oregon, as follows:

"The article is a concise and clear statement of the facts. In the past few years I have laid some 1,700 miles of gravel and crushed stone surfaces and find that to get the most economical and best results both gravel and stone must be completed by travel. A gravel or crushed stone surface that can be compacted immediately after laying by the use of clay fillers and wetting and rolling cannot be maintained.

"A gravel road properly graded and laid at a low cost without wetting or rolling will compact in one wet season under traffic. This class of material can be bladed and plahed into shape continuously through summer or winter. If clays or adobes are used as a filler in order to insure an immediate hard surface, the road will be muddy and slippery in the winter time and will be as hard as a brick in the summer time, neither condition being acceptable in modern highway surfacing."



AUTO PARKING GARAGE SUGGESTED FOR BALTIMORE.

All car movement in and out of building, up and down ramps, and along runway platforms, always in one direction. No crossing of traffic. All cars except last eight to enter take parking position in order shown without backing. All cars as parked headed for exit and can leave in any order. All cars leave building without backing except possibly four nearest door in No. 1 position, which if large cars might require one backing. All doors rolling steel doors, rolling up. Parking lines and positions to be painted on floor.

Georgia State Highways*

Maintenance by the State with meagre funds. Equipment received from Federal government reconstructed by department is its own machine shop. State quarries stone for roads. Organization of department.

MAINTENANCE

The funds at the disposal of the Highway Department provide only about $145 per mile of the state system for maintenance. While this may be sufficient for well-constructed roads subjected to light traffic only, it is entirely inadequate for the proper maintenance of heavily travelled roads that are surfaced with sand-clay or are wholly unsurfaced. The resulting difficulty is accentuated by the fact that the law requires the expenditure of maintenance funds in the various counties in proportion to the road mileage, with entire disregard to the type of surfacing or volume of traffic.

The state has been divided into eleven divisions, each with about 500 miles of highway, and these in turn are divided into sections, each containing generally about 50 miles, which is in charge of a patrolman. It is realized that these patrol sections are entirely too long.

Each patrol section is supplied with light equipment for routine work consisting usually of two small tractors, two road machines, one light truck, one F.W.D. truck, one maintainer, three small drags and the necessary small tools. The patrolman is generally assisted by a machine operator as truck driver, and three or four laborers.

The general procedure is to drag as great a length as possible after each rain. This prevents the formation of deep ruts, maintains a crown for shedding stormwater and replaces a large percentage of the material washed off during heavy rains. During intervals between rains the patrolmen and their helpers prepare guard rails, remove debris and weeds, open ditches, etc. In spite of this maintenance conscientiously performed, the roads in time become rough and uneven and each division is provided with three or four gangs using heavy equipment consisting of one 10-ton tractor, a heavy road machine, a 3-ton truck, a mowing machine, and the necessary small tools. The photographs on page 7 of the January issue show the use of light and of heavy equipment in road maintenance.

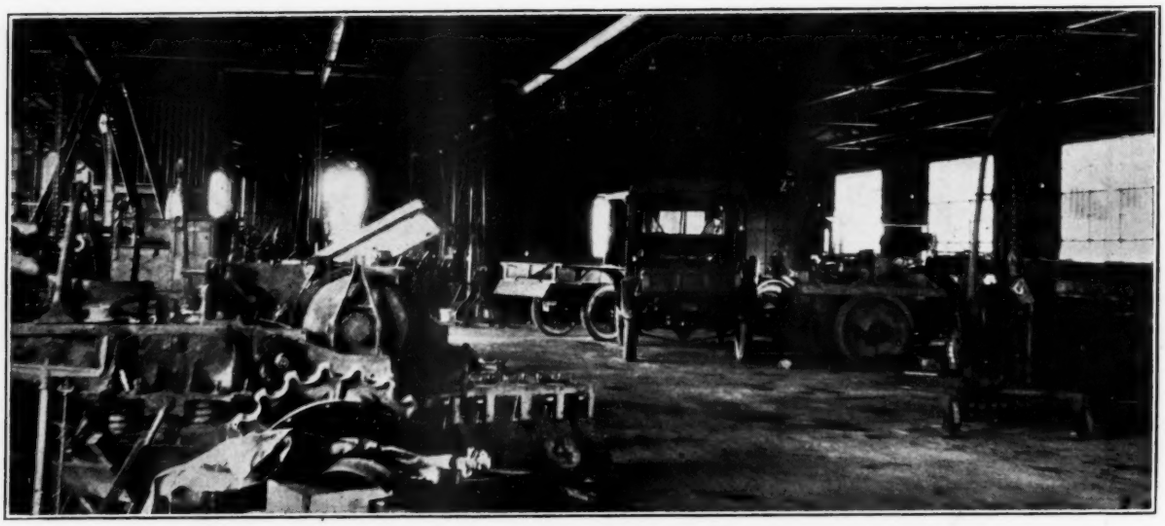
EQUIPMENT

Most of the equipment used in the state is surplus war material received from the Federal Government; but part of the equipment received from the Government has been sold and with the proceeds, about $200,000, the state has purchased additional equipment such as drags, graders, scarifiers, road machines and light touring cars and trucks. Part of the equipment is loaned to the counties for their use and part is used by the state for maintenance purposes.

An equipment depot has been located at East Point, just outside of Atlanta, where equipment newly received is overhauled and reconstructed, that in use is repaired and reconditioned, and some equipment is stored. Here are located a warehouse and office building 160 feet by 66 feet, a shop 210 feet by 66 feet, hangars used for storage purposes, wooden sheds and other buildings.

The repair shop is divided into complete repair units such as machine shop, paint shop, electrical repair shop, tractor repair shop, etc. It is equipped with high-grade machinery, prac-

*Continued from page 10.



ONE END OF MACHINE SHOP, GEORGIA STATE HIGHWAY DEPARTMENT.

tically all of which was supplied by the Government. By utilizing spare parts received from the war surplus, entire overhauling jobs are completed at from 60 to 70% of what the cost would be if done by commercial organizations. The equipment depot is in charge of a superintendent of equipment at $3,000 a year, assisted by clerks, watchman, machinists, electricians, etc., the total monthly payroll being approximately $5,000.

Counties receiving loans of equipment reimburse the Highway Department at the rate of 10% of the market value, which covers freight charges, handling and packing. The county contracts that this equipment will be used on such public roads as the state may designate, that it will be handled only by competent labor and will be properly housed and cared for. The equipment is inspected by inspectors from the equipment department every nine or ten months. It is in general receiving good care, the majority of the divisions having division mechanics to attend to this and make minor repairs to all equipment used in the division. It was found, however, that some counties were taking little care of it and some none whatever.

The equipment is charged against the division receiving it. For Ford touring cars and trucks the charge is $200, for trucks up to 2 tons, $625, for 3 to 5-ton trucks $800, small tractors $450, 5-ton tractors $800.

STATE STONE QUARRY

For the purpose of securing an adequate stone supply for road improvement purposes, the department in April, 1921, purchased a stone quarry in the northeastern part of the state, containing about 70 acres of stone, paying $90,000 therefor. Plant, construction and engineering fees brought the total capital expenditure up to $142,517. Most of 1921 and a part of 1922 were devoted largely to removing the overburden, although a little over 8,000 tons had been turned out by the end of 1922, most of it having been sold to counties for road construction or used by the State Department.

The rated output of the rock-crushing equipment is approximately 100 tons a day, and 80 tons a day has so far been obtained. The quarry has a fifty-foot face of solid stone above the floor level, which is fifty feet above the stream bed, making possible gravity operation throughout. The rock quarried is that known as biotite granite, a material that is hard, tough, with an excellent resistance to wear and exceedingly small absorptivity. It is believed that at least fifty counties in the state can be served profitably from its location. At the time of the report there were employed at the quarry and crusher a superintendent, a mechanic, a hoist man, a blacksmith, a fireman, a drill man and thirteen laborers. The equipment includes a guy derrick, engine, 9,000 feet of track with switches and turnouts, steamshovel, fourteen dump cars, two crushers, three steam boilers, air compressor, and other small pieces of equipment. The plant will be operated by electric motors by power obtained from a hydro-electric power plant on Broad River nearby.

In operating the quarry, stone up to 30 inches will be taken by a large crusher and passed on to a No. 7½ crusher and from this to a No. 5. An endless belt will carry the crushed stone to

QUARRY AND CRUSHING PLANT OWNED AND OPERATED BY GEORGIA STATE HIGHWAY DEPARTMENT.

screens over a large bin, from which the different sizes will be loaded by gravity into railroad cars.

DEPARTMENT ORGANIZATION

Prior to 1908 sole jurisdiction over road matters rested with the counties. Since then this work has been in the hands, first, of the Prison Commission, and later of a State Highway Department. The department was reorganized in 1919 and now is managed by a board consisting of three members appointed by the Governor, one from the southern, one from the middle and one from the northern portion of the state. Each member of the board serves for six years. A state highway engineer is appointed by the board and serves during its pleasure, and his salary is determined by it. (In 1923 it was $6,000—the same as that of the chairman of the board.) The present law created a system of state aid roads connecting the several county seats which totals 5,500 miles and includes 2,430 miles of earth, 2,550 of sand-clay or topsoil, 265 of gravel, 145 of concrete, 95 of waterbound macadam, and 15 of asphalt.

The executive head of the engineering work of the State Highway Board is the State Highway Engineer. An assistant state highway engineer acts for him in his absence and has direct personal supervision of the engineering force at headquarters, of the purchasing division and of tests made at the University of Georgia. A division engineer has charge of all activities, both construction and maintenance, in his division and is aided by an assistant division engineer. A construction engineer acts as a liaison engineer

MAIN BUILDING, CONTAINING HEADQUARTERS OFFICES. IN BACKGROUND; SHOP IN FOREGROUND.

between the state highway engineer and the division engineer in matters pertaining to construction, while a maintenance engineer performs the same duties in matters pertaining to maintenance. A bridge engineer has charge of the designing and construction of all bridges built by the state. A superintendent of shops has charge of all equipment and of the jobs of repairing and reconditioning equipment.

Each division has a division cashier, a maintenance supervisor, an engineer of construction and an engineer of surveys.

The maintenance supervisor has charge of a reconstruction corps, a bridge repair corps, a division mechanic and helpers, and patrolmen assisted by truck drivers, tractor and machine operators and laborers.

The reconstruction corps uses the heavy equipment in reconstructing roads that can no longer be maintained with light equipment. The bridge repair corps maintain and repair the bridges in the state highway system.

The division mechanic makes difficult adjustment and minor repairs to trucks, tractors and other equipment.

The patrolmen use the light maintenance equipment and each is directly responsible for the proper maintenance condition of his section.

The engineer of construction uses a survey corps and inspectors in supervising the construction projects.

The engineer of surveys, by means of a corps of surveyors, makes surveys and plans for construction projects, recommending grades and alignment to the division engineer.

The department has completed surveys and plans for 1,334 miles of highway at an average cost of $227 a mile, of which $127 was for surveys and $100 for plans. This cost compares favorably with the cost of similar work done in other states. The cost on different projects of course varies, that of surveying from a minimum of $10 to a maximum of $692; and that of plans from $8 to $629.

Signs on Pennsylvania Highways

The Pennsylvania Department of Highways has ordered its engineers to remove immediately from all state routes all signs or advertising matter illegally placed. Under the law no signs of any kind other than those erected by the Department of Highways may be placed on a state highway route; this applying not only to advertising matter, but also to direction signs placed by individuals, associations or municipalities themselves.

This would seem to prevent cities from erecting street name signs, direction signs or any others along streets of cities which are included in state highway routes. We do not suppose that the Highway Department would enforce the law in this respect, but it calls attention to one of the features of most state laws relative to state and county routes passing through cities. For instance, our attention was called some time ago to the application of such a regulation whereby a city was prevented by a county from sprinkling its main street, which was very dusty, because this street was a part of the county highway.

Jacksonville City Planning Commission

At the suggestion of the Chamber of Commerce of Jacksonville, Fla., the mayor has named a city planning commission for that city, appointing Frank P. Dearing, whom the commission elected as chairman, Horace C. Avery, elected vice-chairman, and George W. Simons, elected secretary. Mr. Simons is chief sanitary engineer of the State Board of Health.

Sacramento's Filtration Plant*

The largest on the Pacific Coast. Manufactures its own alum and chlorine. Pumping plant all operated by electricity and is in duplicate, including two companies furnishing current. Difficult construction of intake pier and pumping station foundations.

The largest filtration plant on the Pacific Coast, that of Sacramento, California, with a capacity of 48,000,000 gallons a day, was put into operation on Jan. 1, 1924. The plant cost $2,700,000, a bond issue for which had been voted by the people of Sacramento on June 26, 1919, after a forty-year campaign which was organized and carried on by the Sacramento Chamber of Commerce. The opening of the plant was made the occasion of a great celebration by the city.

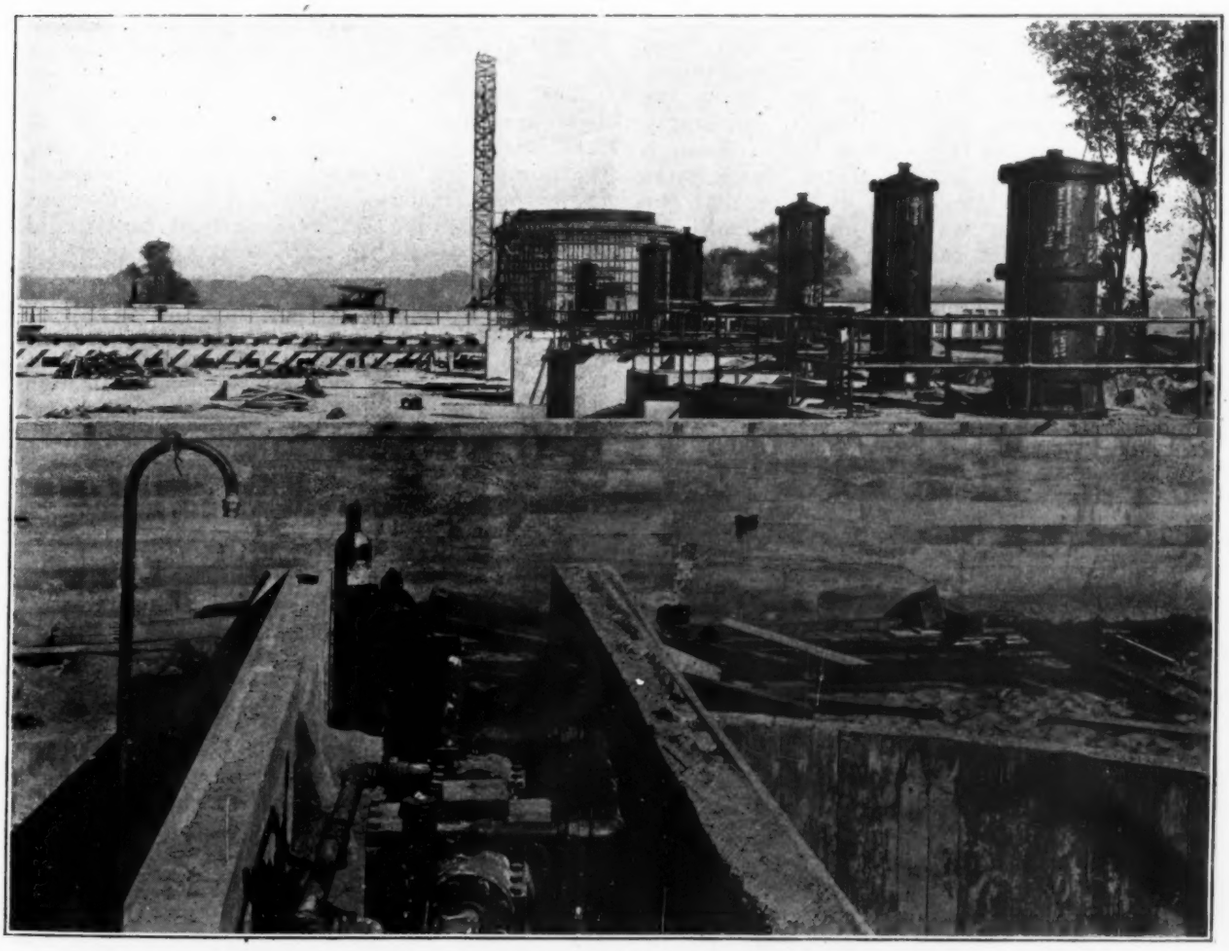
The supply will continue to come from the American and Sacramento rivers, which, for some time past, had been chlorinated but had not been filtered or otherwise treated.

The principal features of the complete plant comprise an intake pier, pumping station, grit removal and storage basins, coagulating tanks, sedimentation basins, clear-water reservoir, head house and filters, alum manufacturing building, and force mains to the city.

The city will manufacture its own alum for use as a coagulant, and an electrolytic chlorine plant installed in the head house will furnish the chlorine for disinfection of the filtered water.

The river water flows by gravity from the intake pier in the river to the low-lift pumps in the pumping station, a distance of about 1,100 feet. Screens of rectangular steel bars are placed over the openings in the intake pier for keeping out logs, brush and other coarse floating material. The low-lift pumps raise the water

*From information furnished by George J. Calder, resident engineer, and Albert Given, city engineer of Sacramento.



GENERAL VIEW OF PURIFICATION PLANT UNDER CONSTRUCTION.

In background, head house. At the left, aerator nozzles above sedimentation basin. At the right, hydraulic gate cylinders on coagulant basins. In the foreground, water motor on coagulant tank.

to a sufficient height to enable it to flow by gravity through the entire plant to the suction well of the high-lift pumps, which discharges the purified water through the force mains to the city.

After passing the low-lift pumps the water is sprayed into the air through a system of aerator pipes and nozzles, with a view to diminishing tastes and odors due to algae and other micro-organisms which develop in the water at certain seasons of the year. The water then passes through a grit basin, and from there into a storage basin which provides for fluctuations in water consumption during the different hours of the day. From the storage basin the water enters coagulating tanks through a controlling gate which maintains a constant level of water in the tanks and on the filters. A solution of aluminum sulphate is added in these tanks and thoroughly mixed with the incoming water. From the coagulating tanks the water passes into the sedimentation basins. The sediment from these is removed at intervals through drainage lines provided for the purpose. The water then passes to the rapid sand filters, from them to a clear-water reservoir and from this to the high-lift pumps.

THE INTAKE

The intake pier is a concrete structure 82 feet high built in the river channel 182 feet from the east bank of the stream and connected therewith by a suspension bridge. In the interior are two compartments, separated by a diaphragm wall, into which the river water enters through five 4-feet by 6-feet hand-operated sluice gates placed at different elevations in order that the operator may draw water from any depth desired, generally that carrying the least amount of sediment.

The pier is approximately oval in shape with a cut-water pointing upstream. It rests upon rock foundation about 40 feet below the bottom of the river and is carried up to a point safely above the highest flood water. It is surmounted by an attractive superstructure containing the controlling and lifting mechanism for the gates and bar screens. The pier was designed to withstand an impact of a loaded barge weighing 500 tons floating down the river against it.

In constructing the pier an open cofferdam of steel sheet piling was built in the form of a rectangle surrounding the site of the pier and the river bottom was then dredged out to the underlying cobblestones, after which concrete was poured over the entire area to form a seal and permit water to be pumped out of the cofferdam. The pier was then built up in the dry.

Two 60-inch concrete conduits are laid side by side below the river bed from the intake pier to a bridge pier on the river bank, where they rise vertically and connect to two 60-inch riveted steel suction mains laid with centers 7.0 feet above low water, which pass through the levee and connect to two 60x54x42-inch Y branches inside the levee. At this point the 54-inch branches are flanged for future connection and from the 42-inch branches two 42-inch riveted steel lines encased in 4 inches to 6 inches of concrete are laid to the pumping station. At a point 75 feet from the pumping station there are two 42x54x60-inch Y branches laid in the opposite direction with the 54-inch connections blank flanged. At the station the center line of the conduits is 8 feet above low water, or 1 foot higher than at the bridge pier. From the Y branches two 60-inch riveted steel lines encased in concrete are laid easterly under the pumping station, where they drop down to an elevation of 17 feet below low water.

It will be seen that whenever the river-level is in the vicinity of 8 feet above low water, water will flow through the intake conduits by gravity, and when the river is below elevation 6¼ feet, the intake will act as a siphon. To insure siphonic action and to maintain requisite vacuum, there are installed in the pumping station two vacuum pumps, each of 40 cubic feet free air capacity, one a Nash driven by a variable speed motor, and the other a Rotrex driven by a constant speed motor, and both operated by automatic regulator starters. The suction lines of these pumps are connected to three siphon vacuum domes on each intake conduit, two on each line at the bridge pier on the river bank and one on each line at the west wall of the station.

PUMPING STATION

The pumping station is operated entirely by electricity and has an installed horsepower of 5,000 with room for doubling that capacity. All the pumps are single-stage centrifugal units of the highest efficiency. The low-lift pumps comprise two 20-inch DeLaval vertical centrifugal 20 m.g.d., driven by 225-horsepower vertical Westinghouse squirrel-cage induction motors; two similar units 18-inch 15 m.g.d., and one 10 m.g.d. The pumps are set with their bases at elevation minus 6.5, while the motors are set on the floor above, beyond the reach of high water. The high-lift units are DeLaval horizontal single-stage centrifugal pumps driven by Westinghouse squirrel-cage induction motors, three pumps being 20-inch 20 m.g.d. and two 18-inch 15 m.g.d. These units are set on the main pump floor at elevation plus 8 feet. Provision has been made for adding both low and high-lift pumps having 200,000,000 gallons capacity. Electric current is obtained from two large power companies that serve this territory and divide the load between them, each of which has installed two 11,000-volt power cables to the plant.

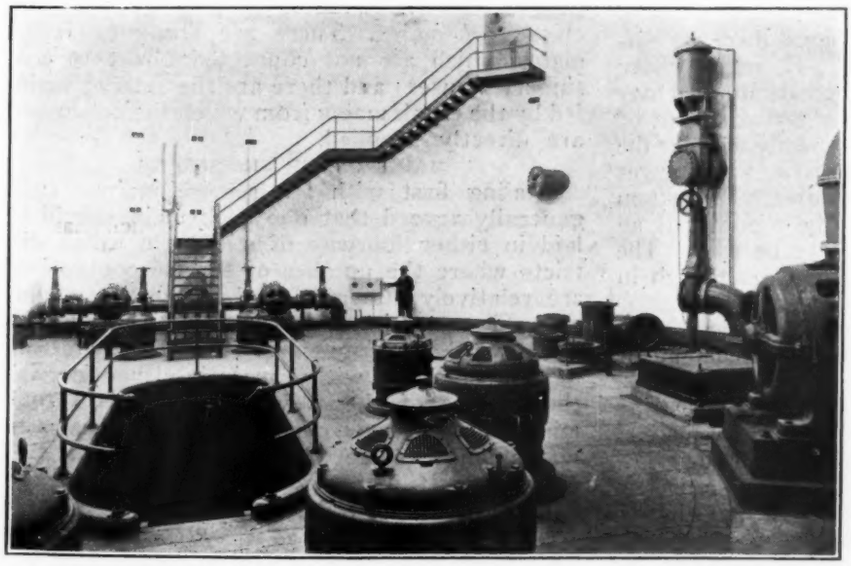
Constructing the pumping station offered unusual engineering difficulties owing to the character of the soil. Ground water was encountered a few feet below the surface and the wet material flowed like quicksand so that it was impossible to make the excavation in open cut. This difficulty was met by sinking the substructure of the pumping station as an open caisson in the form of a concrete cylinder 75 feet in diameter with a cutting edge on the bottom. Successive rings 10 feet in height were poured

and the structure sank of its own weight, the material within being meantime excavated by means of a clamshell bucket. By carefully manipulating the excavation and the pumping within the cofferdam, the cylinder was finally brought to within a fraction of an inch of its predetermined elevation and position, the concrete cofferdam then having reached a height of about 60 feet. A concrete bottom was poured under water to form a seal and the water was pumped out and the work finished in the dry.

The main floor of the building rests on the top of this cylinder. Over this was erected a superstructure 78 feet by 128 feet which provides space for transformer banks and other electrical apparatus, machine shop, offices, lavatory and locker rooms. A 10-ton "Cyclops" 3-motor traveling crane of 73 feet 6 inch span can be used to pick up a pump, motor or other piece of equipment and carry it to the machine shop floor for repairs. Perhaps the most interesting feature of the station design is the manner in which the operation of the entire equipment is controlled from a single group of switchboards and panels on the high-lift pump floor. From this point the operator can start or stop any of the pumps, or open or close any of the large valves or sluice gates. Indicating and recording gauges nearby enable him to tell at a glance the stage of the river and the water levels in all parts of the plant, and register continuously the amount of water being pumped to the city.

PURIFICATION PLANT

The grit chamber, storage basin and sedimentation basins are combined in a single structure in the center of the layout and cover an area of about 282 feet by 193 feet. The aerators are above the sedimentation basin and consist of 420 nozzles for spraying the water into the air. The sedimentation basins are built below the floor of the storage basin, an economical arrangement and one providing a covered reservoir into which no impurities can enter.



HIGH SERVICE PUMP FLOOR, SACRAMENTO PUMPING STATION.

ELECTRICAL CONTROL BOARD, SACRAMENTO FILTRATION PLANT.

Four coagulating basins are located at the south end of the sedimentation basin, each 44 feet in diameter and 22 feet deep. Specially designed paddles operated by hydraulic motors mix the alum and water. The alum used is manufactured at the plant from bauxite and sulphuric acid, the former stored in bins in the alum manufacturing building and the latter in tanks nearby.

There are eight filters, four on each side of the operating gallery. Each filter box is about 60 by 24 feet. The collecting system consists of pipe laterals extending across the width of the filter box at 1-foot intervals and perforated along the lower side. Graded gravel extends for a depth of 18 inches above the bottom of the box, above which is 30 inches of filter sand, a good quality of which is obtained within easy shipping distance. It is expected to maintain a depth of about 6 feet of water on the filters.

After leaving the filters, the water is chlorinated and flows by gravity to the filtered water reservoir.

Each filter is controlled separately by its own panel board, on which are located gauges indicating the rate of discharge, amount of head on the filter, amount of wash water being used, etc.

At the entrance to the filter operating gallery is the tower-like head house, in which, above the main floor, is a steel tank of 270,000 gallons capacity for supplying wash water. This tank is filled by water pumped from the filtered water reservoir. In the head house are also chemical and bacteriological laboratories and the superintendent's office.

The filtered water reservoir is a concrete structure 293 feet by 147 feet and 20 feet deep, holding about six hours' supply. Like the storage basin, this acts as an equalizing reservoir to take care of peak loads.

The entire plant is believed to be safe from all interference by flood. All essen-

tial units are in duplicate and means are provided for by-passing certain portions of the plant to permit of repairing or cleaning.

Operating Imhoff Tanks

A paper entitled "Some Problems in the Operation of Imhoff Tanks," was read before the Fifth Annual Conference on Sewage Treatment at Ames, Iowa, on October 22nd, by Professor Earle L. Waterman of the University of Iowa. Professor Waterman introduces the paper with the statement that an Iowa State Board of Health bulletin, issued last year, contains the information that of the 185 sewage treatment plants in the state, the Imhoff tank is used as a feature in 61. Presumably the paper which he has prepared is based largely upon information which he obtained in more or less frequent contact with these plants.

Beginning with a discussion of the principles of design of the Imhoff tank, Professor Waterman then describes the regular operating procedure, dealing with this under the eight heads of "Cleaning Screens and Grit Chambers," "Cleaning Sides and Bottom of the Settling Chamber," "Removing Floating Material from the Sedimentation Chamber," "Equalizing the Deposit of Sludge," "Treatment of Scum on the Gas Vent Chambers," "Observing Depth of Sludge," "Drawing Sludge," and "Drying Sludge." Most of the suggestions under these heads are in line with standard procedure in operating this class of tanks.

Following these suggestions, the author discusses some operating problems, which he classifies under the four heads of, "Occurrence of Septic Action in the Sedimentation Chamber which Results in a Cloudy, Odorous Effluent"; 2, "Clogging of Slots which Prevents Proper Disposition of Sludge"; 3, "Clogging of Sludge Pipes"; 4, "Foaming at the Gas Vents." He states that "in a well-designed Imhoff tank most of these difficulties arise as the result of inefficient operation and may be overcome by carefully following the operating procedure outlined above." A very common cause is that a tank is called upon to do more work than the designer planned it to do. Among some suggestions for solving these problems are the following:

When sludge pipes become clogged there are different ways of cleaning them. If water under pressure is available, a hose with nozzle attached may be dropped down the sludge pipe and a stream of water through this nozzle will frequently dislodge the obstruction. If this is not successful, a soil auger attached to a shaft long enough to reach the bottom of the sludge compartment may be tried; or if an auger is not available, a hook may be used. The obstruction is usually formed by rags, although in some cases it is due to solidification of sludge.

Among the causes of foaming he mentions overloading of the plant, excessive accumulation of sludge, inadequate gas vent area, oil from garages, septic sewage, and wastes from creameries. During the past summer the author had seen gas vents boil over five times in one day in spite of thorough hosing of them. "The sludge produced by the tank in question had a practically neutral reaction—it was neither acid nor alkaline to litmus. And yet the addition of hydrated lime to the tank every other day certainly decreased the foaming tendency, although it did not entirely eliminate it." This tank was designed in 1916 for 2,000 population on the basis of 1.25 cubic feet per capita, but was receiving sewage from 3,000 people. From his experience he judged that a sludge capacity of 2 cubic feet per capita was desirable.

"Drawing sludge frequently and in small amounts will often correct foaming conditions. In some cases the installation of fine screens ahead of the Imhoff tank is efficacious. Such a procedure really amounts to reducing the load on the tank. Wastes which make the sewage acid, such as those from creameries, should be treated separately. If for any reason they are temporarily present, lime should be added to neutralize them."

Locations of Pipes in Streets*

By Stephen Lacey †

English engineer advocates laying mains under sidewalks, with one under each sidewalk in the wider streets. Subways of limited practicability.

In the matter of the position that mains should occupy in public streets, there are two chief points of view to be considered. In the first place it is obvious that mains should be laid in positions which will necessitate the least possible disturbance of the street either when the main is originally laid or subsquently; this from the standpoint of the street authority and street user alike. In the second place, attention must be paid by the undertaking owning the mains to the relative costs incurred by the adoption of alternative positions. It will, I think, generally be found that the two contrasted points of view lead to conclusions which are not in conflict with one another.

In any distributing system, whether water, gas or electricity, there are, in general, two classes of mains. There are trunk or feeder mains which are not connected direct to consumers' houses; and there are the smaller mains fed by the trunk mains from which the consumers are directly supplied.

MAINS UNDER SIDEWALKS

Dealing first with the service mains. It is generally agreed that one such main should be laid in either footway of streets in urban districts where the number of service connections are relatively numerous and where the volume of traffic necessitates the laying of a high-class paving in the carriageways. The reason for this, of course, is that with a main in either footway the lengths of the services are reduced to a minimum, and new connections and repairs to mains can be made without disturbing the carriageway. It is impracticable to lay down a hard-and-fast rule, defining the circumstances

*Paper before Institute of Gas Engineers (England), somewhat abridged.

†Distributing engineer to the Gas Light & Coke Co.

which warrant the laying of duplicate mains; each case must be considered on its merits. The provisional rule adopted by the author in setting out the distributing systems for housing estates developed since the war has been to lay single mains in subsidiary streets where the width of the carriageway is about 25 ft. or less, and to lay close to the curb line in one of the footways, the idea being that if in the future a change in conditions should make it desirable to lay a second main, both mains and all the service pipes would then lie clear of the carriageway. When single gas mains are laid in one footway to supply customers on both sides of the road, they have to be laid at a greater depth than usual, because service pipes conveying gas have to be laid with a fall to the main in order to provide for the collection and removal of water condensed from the gas.

In thoroughfares with wide footways it may be practicable to lay trunk mains as well as smaller mains in the footways, but usually the footways are not wide enough to do more than accommodate all the service mains and cables. But there is less objection to laying trunk mains under carriageways than the service mains, for the reason that as no service pipes are connected to them, they are not often opened up after having once been laid.

The depth at which mains are normally laid below the surface of the street depends to some extent upon what they carry. Water mains have to be laid at such a depth as to be out of reach of frost. Three feet is considered the minimum safe depth. The depth at which gas mains are laid is not limited in this way, and it is usual to lay at about 2 ft. 6 in. under carriageways and at 2 ft. under footways. It would appear reasonable to assume that the greater the depth at which a main is laid the less the risk of damage by vibration or other causes. But this assumption is not borne out by experience. The solidity and uniformity of the bed on which the pipes lie are the factors that have the greatest influence in establishing and maintaining conditions which ensure the stability of the mains under the stresses due to vibration, etc., and in the author's experience the depth at which the main is laid has proved to be as secondary importance.

SUBWAYS

The construction of subways has often been advocated as a remedy for the opening up of streets for alterations and additions to mains; but they can only be economically built under special conditions. An examination of the existing subways will show that they have practically all been built in new streets such as the Victoria Embankment, Holborn Viaduct, and Kingsway, which have formed part of great reconstruction schemes in areas already highly developed. Schemes to build subways in existing streets already congested with mains would involve not only the cost of building the subway but the cost of diverting the existing mains. This would certainly prove to be prohibitive. It must also be said that subways will always be a potential source of danger so long as bomb-dropping from the air is a possibility.

It must, of course, always be borne in mind when discussing the question of the position of mains in public streets that the distributing systems of water and gas undertakings in particular have not been laid down in the last few years, but are to a great extent heritages from the past which can only be slowly and laboriously modified to conform to present-day requirements. The settled policy of all progressive undertakings owning mains under public thoroughfares is to take every opportunity afforded by the re-paving works of road authorities to overhaul and modernize their plant. New mains are then laid in the footways where possible, and superfluous mains and service pipes under the carriageways thrown out of use. The importance of ensuring that this work shall be carried out thoroughly and expeditiously is becoming more and more generally recognized. That being so, the cordial co-operation of road authorities and the undertakings, which is essential to successful working, follows as a matter of course.

Snow Removal in Pennsylvania

Snow removal crews of the State Highway Department this winter will be at work on 2,700 miles of state highway—800 miles more than during the winter of 1922-23.

"Lowest Responsible Bidder"

In complying with laws or regulations calling for the awarding of contracts to the "lowest responsible bidder," it is common practice to determine the "lowest" first and then find out whether he can be considered responsible. The Kentucky State Highway Department and some others have reversed this process and accept bids only from those whom they consider responsible, on the theory that in this way there is less liability of awarding the contract to an inefficient or otherwise undesirable contractor.

Recently the Miller Butterworth Co., engineers of Little Rock, Ark., followed this plan in obtaining bids on a flood protection job. They asked each contractor who wished to bid to answer, in strict confidence, the following questions, the answer sheet to be returned to the respective bidders as soon as their status had been determined from it. The questionnaire was:

SKILL

1. How long have you been in business as a contractor?
2. How long have you been in responsible charge of work?
3. What training in school, college, or elsewhere have you had to fit you for this business?
4. Give a concise outline of similar work you have done, with examples and dates from your start in the contracting business.
5. Give a list of similar work to that in view, with brief description, size, location and date, that you have executed.
6. Have you a skilled superintendent now in your employ competent to be entrusted with executing the work in your view?

7. State the training and experience of the man you propose to put in charge of this work.
8. Have you now in your employ the principal assistants to the works' superintendent for the work in view?
9. State their position, training and experience.
10. Do you propose to sublet any parts thereof, if contract is awarded to you, or execute it all yourself?
11. What part or parts do you propose to sublet if contract is not executed by you?

INTEGRITY

12. Gives the names and address of the last five engineers and the owners of the work, with address, for whom you have completed contracts.
13. Will you give them as references?
14. Have you any objection to my inquiring of any or all of them about you?
15. If so, why?
16. Give any other reference you care to.
17. Has any work been taken out of your control because of dissatisfaction of engineer or owner?
18. If so, describe the case.
19. Have you had controversies with your sub-contractor or with improvement districts?
20. If so, state the nature of them.
21. Have any of your contracts resulted in lawsuits?
22. If so, describe the cases.

RESPONSIBILITY

23. I estimate that if you fulfill the requirements of plans, specifications and contract as to progress, the amount of cash and credit exclusive of equipment required before the first substantial payment is made will be $20,000, and that the maximum requirements of cash or credit in the most active period of the work between payments will be $30,000.
24. Have you the required resources in cash or credit?
25. Give a condensed statement of assets and liabilities.
26. Will the above condensed financial statement favorably compare with the detailed statement you will render a surety company when applying for a bond?
27. What volume of work have you unfinished?
28. How much cash or credit does this require?
29. How much cash or credit does this leave free for other work?
30. I estimate approximately that the following plant will be the minimum amount needed to properly handle this work: Locomotive crane, clam shell bucket, steam pile driver, concrete mixer, 200 lineal feet of forms, unloading crane with bucket, bins for materials, means for transporting materials.

Have you this amount of your own available for the work?

32. If not, do you know that you can get it as and when needed?

Wilmington's New Incinerator

By Harry L. Maier *

Description of three-unit plant with capacity of twenty-five tons a day. Result of a test run of five weeks, and of twelve months of service operation. Figures for latter compare favorably with those obtained during the test.

In 1921 the city of Wilmington, Delaware, put into operation a refuse incinerator specified to have a capacity of from 40 to 50 tons of mixed refuse per day. In service, however, it developed a capacity of only 36 tons, and as the amount of refuse to be disposed of was over 80 tons a day, some further action was immediately necessary. In September of that year, Prof. John H. Gregory reported on conditions (an abstract of the report was published in PUBLIC WORKS for Oct. 22nd, 1921) recommending a new and larger incinerator.

Following this report, a contract was let for a Davis incinerator consisting of three units, each with a guaranteed capacity of 25 tons per 24 hours. A test run of this incinerator was made between July 17th and August 19th, 1922. The plant has been in continuous operation since that time.

The incinerator is housed in a building 36 feet by 54 feet in plan and two stories high, covered with a peaked slate roof having a monitor running the entire length. The walls are of brick resting on a reinforced concrete foundation and all windows and sash, doors and door frames, are of metal. The firing room floor is of plain concrete. The second or charging room floor is of reinforced concrete supported by columns and the sides of the building, so that no part of it is connected to any part of the furnace. This building was placed with the old incinerator building between it and the road and with the charging floor of the new plant about 3 feet above that of the old incinerator, and the refuse wagons use the old ramp and the charging floor of the old incinerator as a part of the approach to the new incinerator, an inclined roadway connecting the two buildings. It was necessary to strengthen the floor of the old plant to make it safe for this service. The floor of the new plant was designed for trucks having a gross weight of 18,000 pounds.

The furnaces were built up from fireclay, with each furnace encased within 9-inch walls of regular hard burned brick, the walls of each furnace being securely tied together by means of buck stays and tie rods, independent of the other furnaces. The three furnaces are connected to a combustion chamber which is supported by reinforced concrete columns and the outside walls of which are constructed of hard burned brick protected by a lining of 8-inch firebrick. The combustion chamber is direct-connected to a brick stack 6 feet in diameter and 100 feet high. Each flue between furnace and combustion chamber is provided with a damper making it possible to put any furnace out of service for repairs, or because of insufficient refuse to keep all in operation.

The plant was completed July 8th and slow fires placed in the furnaces July 14th to dry them out. The test run was started on July 17th and continued for five weeks, the first week being devoted to breaking in the workmen who were to operate the plant during the test. As they had been employed on the other incinerator,

*City engineer of Wilmington and ex-officio member of the Board of Health.

they soon became proficient in operating this one.

All garbage and refuse brought to the incinerator was weighed, as was all coal used during the test. The amount of garbage was not sufficient to test all three furnaces at once, and two furnaces only were used during the second week, but all three furnaces during the last three weeks. During the second week a total of 294.42 tons of garbage was consumed in 126 working hours (the plant was operated only 6 days a week), the plant operating only 14 hours on Monday and 16 hours on Saturday, but 24 hours for each of the other days. This gives an average consumption by the two furnaces of 56 tons per day, or 6 tons above the guarantee. The amount of coal used this week was 62,078 pounds, or an average of 211 pounds per ton of garbage. The coal obtainable by the city in 1921 was of a very poor grade, and it was believed that with good coal the same work would have been performed by considerably less. (As a matter of fact, the amount of coal consumed during 1923 averaged about 158 pounds per ton of garbage.) Moreover, the garbage burned that week was very wet. Professor Gregory had advised that the citizens be compelled to wrap their garbage, and this was done, but owing probably to rain entering the uncovered pails, the paper wrappings were completely soaked with water when the trucks reached the plant, the moisture content running between 55% and 60%, while that of the apparently dry garbage had been found to be between 20% and 30%. It has been found that garbage collected the day after a rain weighs 600 to 800 pounds more per truck-load than before a rain.

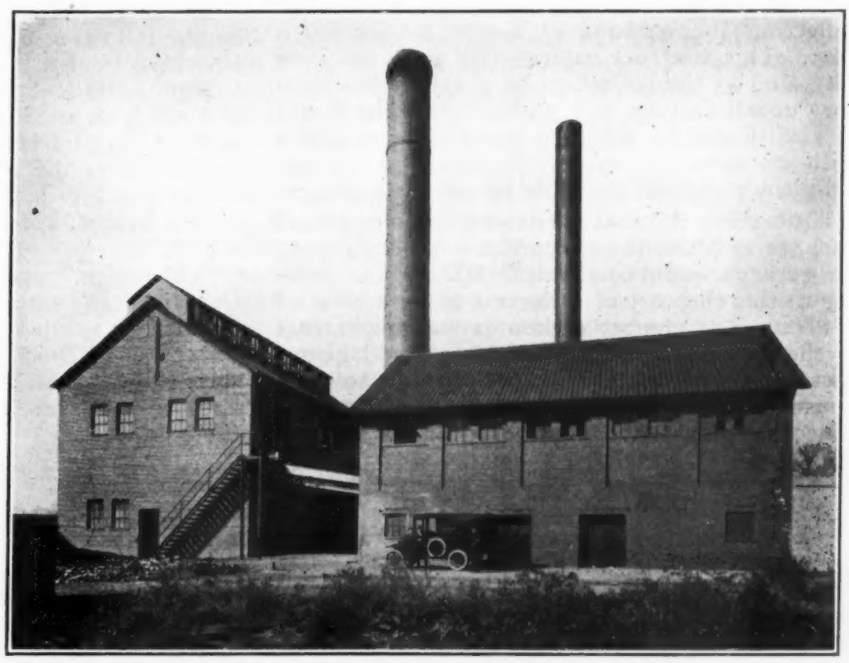
During the fourth and fifth weeks the three furnaces burned an average of 86.6 tons and 88.4 tons per 24 hours, respectively, as compared to the guaranteed capacity of 75 tons. These capacities are calculated and not actual, as there was sufficient garbage to keep the furnaces operating only 14 to 20 hours a day. From observations during the previous week it had been learned that between 3 and 3½ hours was required to destroy a charge in the furnace. In estimating the time a furnace was in operation during the fourth and fifth weeks, 3½ hours was added to the time expired between the first charge in the morning and the time of cleaning off the floor for the last charge at night. The furnaces were kept up to temperature throughout the 24 hours, however, since if the temperature had dropped a thousand degrees, it was feared that it would be disastrous to the fire brick arch, due to the contraction and expansion; and it was necessary, anyhow, to have the furnace up to full temperature before charging it the following day. Two hundred pounds of coal per hour was necessary to keep the furnaces up to this temperature when not burning garbage. In making the calculations of the test, the amount of coal burned merely for the purpose of keeping the furnace hot was not included.

The cost of operating the incinerator was as follows:

9 laborers, at $3.50 per day	$31.50
1 superintendent, $6.50	6.50
Total	$38.00

On the basis of destroying 80 tons per day, there would be added 4½ tons of coal at $7.50, or $33.75, giving a total cost of $71.75, or about 90 cents a ton. If it be assumed that 60 tons per day be destroyed, and estimating 4 tons of coal consumed, we have a total charge of $68, or a cost of $1.13 per ton. The actual cost during the last week of the test, when the average hours per day of operation were 17½, was $1.19 per ton.

It is often assumed, and too frequently perhaps occurs, that the operating costs of a plant cannot be kept down to the estimate based upon a test run. It is interesting, therefore, to compare with the above the actual costs during 1923. The report of the secretary of the Board of Health contains the accompanying table, showing the records of the incinerator for that year. The superintendent's salary of $195 a month is included in the item of "Labor." The laborers received 30 cents an hour during January to May inclusive and 40 cents for the remainder of the year. (In the above estimate 30 cents was used).



NEW INCINERATOR AT THE LEFT; OLD INCINERATOR AT THE RIGHT.

Coal cost $5 a ton (as compared to $7.50 in the estimate). The amount $632.45 under the head of "Hauling" is the expenditure for hauling the ashes from the consumed coal. The labor item for June includes $663.90 expended for trimming the coal pile, and that for July $152.00 for that purpose.

Operating Incinerator During 1923.

	Total tons destroyed	Cost of labor	Tons of coal	Hauling ashes	Unloading coal
January	1278.75	$805.00*	83.75	.....	.....
February	1077.75	660.50*	72	.....	.....
March	1209.25	723.50*	90	.....	.....
April	1158.25	758.50*	89	.....	$10.00
May	1386.50	830.25*	114	$106.00	.....
June	1468.75	1222.90†	131.5	.....	$170.00
July	1594.00	1287.80†	146.00	$93.00	30.00
August	2016.25	1347.00†	163.00	114.45	30.00
September ..	2017.25	1510.20†	156.50	.....	.....
October	1817.00	1414.20†	136.00	101.70	.....
November ...	1505.00	1140.60†	116.50	129.50	.....
December ...	1499.00	1020.60†	124.00	87.80	.....
Total	18028.75	$12721.45	1431.25	$632.45	$240.00

The total expenditure in operating the incinerator was, therefore, $20,750.15, which gives an average of $1.15 a ton. The number of men employed ranges from six in winter to nine in summer. The material burned is practically garbage only, except that the street sweepings are mixed with it.

Comparing the figures for 1923 with the 1922 estimate, we find the cost per ton was $1.15 as compared to the estimate of $1.13. Had the prices for labor and coal in the 1922 calculations been those paid in 1923, the total cost for the year would have been $1.22½, or 3½ cents per ton more than the actual cost of the last week of the test run.

In 1921 the city made a 3-year contract for collecting the garbage at a cost of $48,800 a year. This contract expires this year, on June 30th, and as the collection by contract has been very unsatisfactory, it is probable that the Board of Health will be asked to make the collections with its own employees. If this is done, the old incinerator will probably be used as a garage.

Estimating the cost of destroying one ton of garbage at $1.20, the expenditure for destroying the garbage would be about $26,000 a year. Adding to this the cost of collection gives a total of $74,800. The number of houses and apartments in the city is about 23,000, which would give a cost of approximately $3.25 per year to each householder, or a little over 6 cents a week for collecting and destroying the garbage.

The Mid-Hudson Bridge

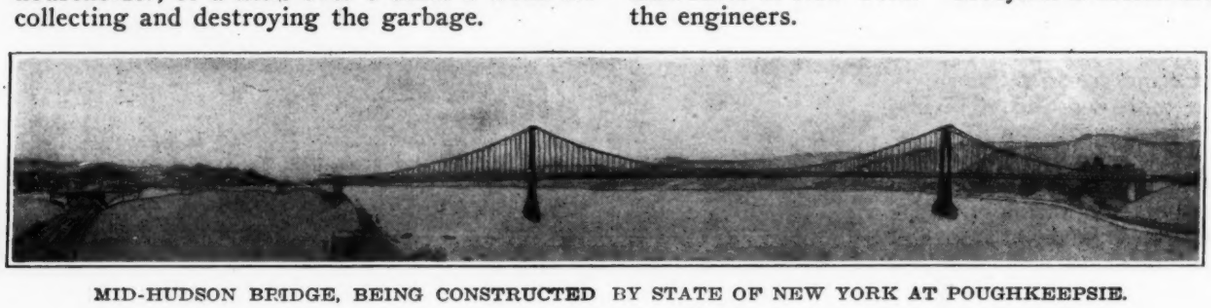
The State of New York is constructing a bridge across the Hudson at Poughkeepsie, which has several notable features. In the first place, there is now no bridge across the Hudson south of Albany, and this will permit motor traffic to cross the river at a point just half way between that City and New York. (There is also under construction a bridge at Storm King Mountain, by private capital.)

Even more interesting, however, is the fact that the bridge is being constructed under a provision whereby, upon completion it is to be maintained as a toll bridge until the collections amount to the gross cost of the structure, after which it will become a free bridge, maintained as is any other part of the State Highway System. This policy is equitable to the tax-payers in two ways:—In effect, the State is advancing money for a much-needed bridge, and this loan will be returned to the State by those most directly benefited, the actual users of the bridge.

In reporting to the legislature this month, Col. Fred'k Stuart Greene, Superintendent of Public Works, said that "the river or main span will be 1,500 feet long, the shore spans are equal in length, being 750 feet long. We have, therefore, a bridge whose river length is 3,000 feet, divided symmetrically, and consequently balanced both as to weight and length of its principal units. The Poughkeepsie approach will be 1,100 feet in length and will require three small bridges, two to cross streets and one of 115 feet span to cross the tracks of the New York Central Railroad. The westerly approach in Ulster County will be a highway approximately 1¼ miles long. The pavement will be of re-inforced concrete, 20 feet in width, widened and banked at curves.

"How closely the Mid-Hudson bridge compares with the East River suspension bridges is seen by the following figures: The river span of the Brooklyn Bridge is 1,595 feet; the Williamsburg Bridge, 1,600 feet; while the Manhattan Bridge is 1,470 feet, or 30 feet shorter than the main span of the Mid-Hudson Bridge. The height of towers above the water are: Brooklyn Bridge, 276 ft. 5 in.; Williamsburg Bridge, 335 ft.; Manhattan Bridge, 322 ft. 6 in.; Mid-Hudson Bridge, 315 ft."

"The bridge," says Superintendent Greene, "while free from any attempt at ornamentation, will be beautiful in symmetry and balance; a bridge which, for size and dignity of design, will compare favorably with the great suspension bridges spanning the East River at New York." Modjeski & Moran are the engineers.



MID-HUDSON BRIDGE, BEING CONSTRUCTED BY STATE OF NEW YORK AT POUGHKEEPSIE.

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Street Paving in 1924

Apparently about the same amount of street paving will be done in 1924 as was performed in 1923. This is the conclusion drawn from a study of the questionnaires returned during the past month by more than five hundred city engineers.

This is the average for the entire country. Some individual cities expect to lay five to ten times as much pavement this year as last; others only a fifth to a half as much. In fact, a number of cities that laid no pavement last year will lay considerable this; while others that carried out ambitious programs in 1923 will do little more than maintenance work in 1924.

If we group the returns by sections of the country we note the following: 20 to 30 per cent. less paving than last year is anticipated for New England, the West North Central, the Middle Atlantic and the Pacific states, the greatest decrease being in the last, and a slight decrease for the East South Central. About 10 per cent. increase is reported for the South Atlantic and East North Central, and 25 or 30 per cent. for the West South Central. The Mountain states have the most ambitious programs, almost every city that reported expecting to double or more than double its 1923 record.

These predictions cannot be considered other than judgments based on indefinite data. While some cities have completed their programs for 1924 and a few have even let contracts for most of the work contemplated, others do not even hazard a guess as to what will be done. Those engineers who report probabilities do so largely on the basis of their judgment, and some are undoubtedly too optimistic, while others are pessimistic. Also, the cost of paving work as it may develop in the spring, and the bond market, will undoubtedly affect the outcome. Using the figures submitted we obtain an apparent increase for 1924 of 25 to 30 per cent. over 1923, but it seems probable that more of the cities not reporting will show a falling off than will show an increase over last year's record, and allowance for this would, in our judgment, give the above as the most probable prognostication deducible from the available data.

Cantonment Construction Committee Exonerated

In December, 1922, bold headlines in the daily papers told of the suit brought by the Attorney General of the United States against certain contractors and others, members of the Construction Committee of the Council for National Defense, for alleged conspiracy to defraud the Government in connection with the cantonment construction in 1917. We wonder how many readers of daily papers noticed the report of the outcome of this suit on January 30.

After resting for more than a year under the stigma of this accusation by the Attorney General, the defendants have been completely exonerated by the Supreme Court of the District of Columbia. On the other hand, the framers and pleaders of the indictment are made ridiculous, and the charge itself given the appearance of persecution due to some motive other than an attempt to secure justice.

"The court is of the opinion that, while the indictment abounds in the statement of conclusions, it fails to support the same by facts alleged as required in a criminal proceeding; . . . the indictment as drawn is not such that the defendants could advisedly plead thereto in the sense of knowing just what they are called upon to answer or what is intended to be proved thereunder. Accordingly the court is of the opinion and so orders that the demurrers filed herein be, and the same hereby severally are, sustained."

From a mass of indefinite generalization there emerges but one definite charge, and that centers on alleged "mistakes or errors in matters of policy which the Secretary of War himself decided"; these being chiefly the construction of the cantonments by a form of contract that did not require competitive bidding, and disparaging the Corps of Engineers of the Army.

There were numerous accusations incidental to the main charge, such as that the cantonments cost more than similar work done before or since; but the court held that no proof was submitted of fraudulently favoring contractors or failing to safeguard the United States.

Apologies of the country for placing and so long keeping them under cruel and unjust suspicion are due to Benedict Crowell, C. W. Lundoff, William A. Starrett, Morton C. Tuttle, John H. McGibbons, Clair Foster and James A. Mears, the men named in the indictment. Their brother contractors and engineers never doubted the injustice of these charges against them, and rejoice that such charges have been thrown out of court as absolutely without foundation.

Hog Feeding and Incineration at Los Angeles

In our January issue we gave some figures concerning garbage collection in Los Angeles, stating in a final paragraph that the Board of Public Works is preparing plans for an incinerator to take the place of hog feeding. We learn that we misunderstood the statement on which this was based, and City Engineer John A. Griffin informs us that the incinerator is for burning rubbish only, and that there is no intention of abandoning hog feeding of garbage.

Nashville-Springhope Highway

In describing the construction of any public work it has always been our endeavor to have mention made of all important equipment used thereon. This is done because we believe it increases the value of the article to our readers by showing them how and by what means progressive contractors perform work of this kind.

In the description of the construction of the highway between Nashville and Springhope, North Carolina, published in the January number of PUBLIC WORKS, the author mentioned by name many of the items of the plant used by the contractor, but failed to include some very important equipment. That not mentioned, so far as we can learn, is as follows: Lakewood subgrader, float bridge and batch boxes. The 192 batch boxes were carried on Koppel cars. Two Pawling & Harnischfeger and one Northwest Engineering Co.'s locomotive cranes, used for handling aggregate at receiving stations; one Novo pump, one No. 9 and one No. 11 C. H. & E. pump, and one Domestic pump, No. 44; White trucks with dump bodies for hauling aggregate on the short section; Handy Sack Baler Co.'s shaker for cleaning cement sacks.

Civil Service Examinations

The New York State Department of Health announces that an examination will probably be held about March 8 for an assistant sanitary engineer, salary $3,000 to $3,500. The duties of the position require a knowledge of the design, construction, operation and supervision of water supply systems, water purification works, sewerage and sewage disposal systems.

Application blanks can be obtained from the Civil Service Commission, Albany.

The United States Civil Service Commission announces the following competitive examinations:

Junior Topographical Engineer in the Geological Survey, salaries $2,040 to $2,640. Examinations, April 23 and 24. Must be graduates of civil engineering courses.

Assistant Examiner, Patent Office, salary $1,740. Examinations, April 9, 10 and 11, in physics, mechanical drawing, technics, mathematics, language, and an optional branch of engineering or chemistry.

Radio Engineer, salary, $4,000 to $5,000 a year; Associate Radio Engineer, $3,000 to $4,000; Assistant Radio Engineer, $2,000 to $3,000. To superintend the designing, construction, etc., of special apparatus and methods of radio communication, radio research, and other related work. Applications received until March 11.

Laboratorian, to assist in physical and chemical laboratories, salaries, $1,440 to $1,740. Examinations April 9 and 10.

Dallas' Big Public Works Program

We are informed by the city engineer of Dallas, Texas, E. A. Kingsley, that that city is contemplating spending something over $2,000,000 on paving during 1924, this including ninety paving projects, of which thirty-five have been awarded and construction on them is just starting. This $2,000,000 worth of paving represents about one-third of the paving program contemplated and will give about 25 miles of 30-foot street. By the end of 1926 the city expects to have added about 75 miles of permanently paved streets. Practically all of the paving will be asphalt surface on 5-inch and 6-inch reinforced-concrete foundation, with concrete combined curb and gutter, the latter being tied into the concrete foundation.

In addition to this paving, the city expects to spend about $300,000 this year on storm-sewer work in connection with the paving. It will also spend $500,000 for a disposal plant and extensions of the sanitary sewer system. Concrete sidewalks are being built at the rate of four to five miles per month, while gas and water extensions are keeping pace with the paving. Surveys have been made for a new water supply, for which $5,000,000 in bonds has been voted, and it is expected that this work, including a reservoir, will be completed by the end of 1925.

Municipal Liability for Snow on Crosswalks

Decisions of the higher courts as to liability of cities, villages and towns for injuries resulting from snow and ice on crosswalks and sidewalks, and distinction between the two.

By John Simpson

ICE AND SNOW ON SIDEWALKS

Mere Slipperiness Not Ordinarily Actionable Defect. —The mere slipperiness of a sidewalk occasioned by ice or snow, not being accumulated so as to constitute an obstruction, is not ordinarily such a defect as will make the city liable for damages occasioned thereby. Morrison v. City of Butte (Mont.) 211 Pac. 208; Storm v. City of Butte (1907) 35 Mont. 385, quoting 2 Dillon, Municipal Corporations, §1006. Reidy v. Brewing Assoc., 161 Mo. 539; Reno v. City of St. Joseph, 169 Mo. 656; Staunton v. Springfield, 12 Allen (Mass.) 566; Henkes v. City of Minneapolis, 42 Minn. 530, 44 N. W. 1026. Numerous other authorities support this statement of the law.

But if the snow or ice is permitted to accumulate and to become rough or uneven, so that the slipperiness becomes more dangerous than if it lay in a smooth surface, it is generally held to constitute an obstruction, which the municipality, with notice thereof and opportunity to remove, must remove or pay resulting damages. Storm v. Butte, supra, citing Aurora v. Parks, 21 Ill. App. 459; 5 Thompson on Negligence, sections 6190, 6191.

The condition of snow or ice constituting an unusual or dangerous obstruction is that condition which exists when the snow or ice is permitted to accumulate in ridges, or in irregular or uneven forms or heaps, in such a manner as to constitute an interference with travel. O'Donnell v. Butte, 211 Pac. 190; Manch, Chunk v. Kline, 100 Pa. 119; McKellar v. Detroit, 57 Mich. 158; Brennan v. New York, 130 App. Div. 267, 114 N Y. Supp. 578; Comstock v. Schuylerville, 139 App Div. 378, 124 N. Y. Supp. 92; Storm v Butte, supra. Wolf v. Kansas City (Mo.) 246 S. W. 236; Nichols v. Village of Buhl (Minn. 1923) 193 N W. 28; Wright v. St. Cloud, 54 Minn. 94; Smith v. Cloquet, 120 Minn. 51; Genereau v. Duluth, 131 Minn. 92.

In a few instances the court has extended the liability to cases where the municipality has, after actual or constructive notice, allowed snow or ice to be upon the sidewalk so as to form a smooth, slippery and slanting surface, "when the snow and ice are made to assume some other form, or present some other danger than they would otherwise solely from natural causes." Griffin v. Marion (1914) 163 Iowa 435, 144 N. W. 1011; Tobin v. Waterloo (1906) 131 Iowa, 75, 77, 107 N. W. 1031; Townsend v. Butte (1910) 41 Mont. 410, 109 Pac. 969; Douris v. Butte (1922) 64 Mont. 211, 207 Pac. 1001. Coughessy v. Waterbury, 51 Conn. 405.

The Connecticut Supreme Court, Coughessy v. City of Waterbury (1883) 51 Conn. 405, departs from what it calls the Massachusetts doctrine that a city is not liable in respect to any smooth ice, in so far as its hold that "if ice is found on the sidewalks to a limited extent, *in a dangerous condition*, whether smooth or otherwise, and the city has ample notice of the fact and can with reasonable expenditure make the passage safe for travel, it ought to do it, and is responsible for the consequence if the duty is neglected." In this case the statement of facts shows that the sidewalk was "nearly level," and constructed with a little slope towards the street. The Connecticut courts, however, "have never undertaken to lay down a rule defining with particularity and precision the duty owed by our towns, cities and boroughs in their dealings with the manifold problems which, in our climate, are presented by formed ice or fallen snow upon public highways or walks. "They recognize the difference of responsibility imposed by the size and resources of the municipality, the severity of the climate and many other elements, and find the keynote of their rule throughout to be "reasonableness in view of the circumstances as they appear upon each occasion." Carl v. City of New Haven (1919) 93 Conn. 622, 107 Atl. 502.

The Missouri Supreme Court sums up its conclusions as to the liability of municipalities for snow and ice on sidewalks, in the recent case of Wolf v. Kansas City (Mo. 1922) 246 S. W. 236, as follows: (1) That when such deposits result from natural causes, like the precipitation of moisture in the form of sleet or rain, of which all are alike bound to take notice, and which operate similarly under similar circumstances over the region covered by such precipitation and freezing, there is ordinarily no liability; (2) that where the deposit is of such a character that the travel of the public along the walk in connection with the condition of the weather

converts the surface into ice ridges or hummocks from which pedestrians are liable to slip and fall to their injury, the liability of the city depends upon its failure to correct the dangerous conditions upon reasonable notice expressed or implied; (3) where the slippery or otherwise dangerous condition results from the act of the city, or the act or negligence in connection with acts of others, or the acts of others with the knowledge of the city, together with its failure or refusal within a reasonable time to correct the dangerous condition, it is liable.

Another recent decision, Ray v. City of Council Bluffs (1922) 193 Iowa 620, 187 N. W. 447, states the principle concisely and lucidly as follows: "A city is not liable for injuries sustained by persons slipping upon ice which is level and smooth, and in this respect it is immaterial where the snow or water forming the ice came from. It is the condition of the snow and ice which is the controlling fact." And the plaintiff was held to have the burden of establishing by a preponderance of evidence that at the time and place he fell, the snow or ice was in a rough, rounded, uneven, sloping or ridged condition rendering it dangerous to pedestrians and that the fall was caused by stepping on some portion of the rough, rounded, uneven, sloping or ridged ice.

Length of Time to Constitute Constructive Notice of Defect. To render a city liable for injuries caused by an accumulation of ice and snow on the sidewalk, it must have had either actual or constructive notice of the defect, and opportunity to repair it. As to the length of time required to put the city on notice, each case must depend upon the character of the defect and the facts and circumstances surrounding it. All these which are relevant must be considered. Where snow had been packed on a sidewalk for four days, so as to become icy and rough, rounded and uneven, the Iowa Supreme Court held, Parks v. City of Des Moines, 191 N. W. 728, that it was a question for the jury, whether the city had constructive notice in time to remedy the defect. Allowing snow and ice to remain for five days on a sidewalk so as to form a slippery and slanting surface was held to show actual or constructive notice of the defect in Douris v. City of Butte, 64 Mont. 206, 207 Pac. 1001.

Contributory Negligence Usually for Jury. The contributory negligence of a pedestrian in going upon a sidewalk in a dangerous condition from an accumulation of snow and ice is usually a question for the jury.

Where the only evidence of contributory negligence of the plaintiff was her own tesitmony that she might have known something about the bad condition of the sidewalk—the uneven and broken condition of a depression in which ice had formed—some months before the injury, but that the recollection of its former unsafe condition did not occur to her at the time she received the injury, the Idaho Supreme Court, Muir v. City of Pocatello, 212 Pac. 345, having regard to the rule in that state that contributory negligence is a matter of defense and that the burden of proving it rests upon the defendant, did not consider it incumbent on the plaintiff to assume that the sidewalk was permitted to remain in this unsafe condition during the interval between the time she observed such condition and the time of her injury. In the Idaho courts the rule is that a person injured by an accident of this kind will not be precluded from recovery on the ground of contributory negligence unless it was such, that upon a consideration of all the facts and circumstances as they appeared at the time, a reasonably prudent person would not have acted as did the injured party; and only when it appears upon the undisputed facts that a reasonably prudent person would have acted differently does it become a question of law. Otherwise the question is one for the jury. See also Nichols v. Bahl (Minn. 1923) 193 N. W. 98; Parks v. Des Moines (Iowa 1922) 191 N. W. 728.

Liability of Townships Differs from that of Cities. Township supervisors or commissioners are under no obligation to construct footpaths; nor can they be charged with negligence in permitting other parties to construct such sidepaths (Siegler v. Mellinger, 203 Pa. 259). The Pennsylvania Supreme Court holds, Shaw v. Plains Tp., 119 Atl. 289, that "to further impose liability on the township for failure to keep such walks clear of ice and snow would be out of all reason, even though the walks were built of wood, brick, or other solid material; the rules of law governing cities as to snow and ice on the streets do not apply to townships. Liability can be fixed only by pointing to some act of assembly or some duty at common law resting on them which has been violated." A judgment against a township for injuries to a pedestrian, who slipped and fell on ice which had accumulated on a dirt sidewalk constructed by an abutting property owner on a street in the township was reversed with direction to enter it for the defendant.

ICE AND SNOW ON CROSSWALKS

Distinction from Sidewalks. The general rule is that a municipality cannot be, in the nature of things, and is not, held to as strict an accountability for permitting ice and snow to accumulate on a crosswalk as it may be for a like accumulation upon a sidewalk. Egan v. City of New York (1916) 175 N. Y. App. Div. 358, 161 N. Y. Supp. 849.

Primarily, of course, it is the duty of every municipality to exercise active vigilance to keep all its streets in a safe condition, suitable for the public use, but it can be held only to a reasonable performance of this duty. It would be a great hardship, and involve ruinous expense, in a climate where the winters are severe, if all the city's streets subject to being affected by winter's storms are to be constantly watched and diligently kept in a thoroughly good condition. No amount of diligence can supply an adequate force or adequate means to prevent the inevitable accumulation of snow during winter storms, or the occurrence of ice during the period when it is alternately thawing and freez-

ing. O'Donnell v. City of Butte (Mont.) 211 Pac. 190, 193.

The New York Court of Appeals said, in Dupont v. Port Chester, 204 N. Y. 351, 97 N. E. 735: "There is a difference in the duty of a municipality regarding the care of sidewalks, used wholly by pedestrians, and crosswalks, or places where people cross over streets which are used in winter with teams. . . Even if the entire removal of snow from a crosswalk is desirable for its use by pedestrians, the ordinary travel upon a street necessarily carries more or less snow upon the crosswalk, and when it thaws and freezes with the varying temperature, it would be quite impossible, except by continuous effort, to keep crosswalks or crossings wholly free from snow and ice."

The Montana Court, citing Williams v. City of New York, 214 N. Y. 259, 108 N. E. 448, states it as a general rule that a municipality is under no duty to keep its street crossings clear of snow and ice, and unless the condition caused by the snow or ice constitutes an unusual or dangerous obstruction to travel, of a permanent nature, a municipal corporation is not liable to a pedestrian slipping on ice or snow on a street crossing and sustaining injuries. And the mere fact that a street, of an unusual slope or construction, is slippery by reason of a smooth coating of ice, from whatever cause arising, does not constitute a defect or a condition for which a city or town is liable. Pinkham v. Topsfield, 104 Mass. 78; Mauch Chunk v. Kline, 100 Pa., 119.

In Brennan v. City of New York (1909) 130 App. Div. 267, 114 N. Y. Supp. 578, affirmed 197 N. Y. 544, 91 N. E. 1110, the claim was that the plaintiff slipped on hard or packed snow or ice on the crosswalk. The court said: "It is not enough to show snow or ice to show that the city was negligent. In this variable winter climate of ours, falls of snow, followed by rain, or by thawing, and then by freezing, and so alternately, from day to day, are common. The city is in no way responsible for such conditions; nor is the impracticable duty put upon it of keeping the streets free of such snow and slush. This general condition all over the city is the work of nature and cannot be guarded against."

A city was held not liable for failure to remove an accumulation of snow and ice upon the cobblestone pavement of an alley crossing within forty-eight hours of the close of a storm, in which the snowfall was about ten inches, where the storm was followed by temperature below freezing point, continuing until after the happening of the accident. Moran v. City of New York (1904) 98 N. Y. App. Div. 301. To the same effect is Battersby v. Mayor, etc., of New York (1877) 7 Daly 16.

In Egan v. City of New York, (1916) 175 App. Div. 358, 161 N. Y. Supp. 849, it was said that to justify a recovery for personal injuries caused by an accumulation of rough and lumpy ice on a crosswalk, the evidence of negligence must be extraordinarily strong.

The Michigan Supreme Court, in McKellar v. Detroit (1885) 57 Mich. 158, held that the state statute, Hon. Stat. §1442-6, applied only to injuries from defects caused by lack of repair of streets and crosswalks and not to those caused by mere accumulations of snow and ice. The injury here was caused by the fall of a pedestrian on a small ridge of trampled snow on a crosswalk. The court said: "No amount of diligence can supply an adequate force and adequate means to detect the inevitable accumulations of snow trampled into hardness on every crosswalk or in every roadway."

Where a depression in a crosswalk had been filled with ice, smooth and level, which had accumulated through the sole agency of the elements, it was held, Chamberlain v. Oshkosh, (1893) 84 Wis. 289, that the ice and not the depression was the proximate cause of injury to a pedestrian who fell on the smooth surface, and that such condition did not constitute an actionable defect.

Where a pedestrian fell by slipping on a large sheet of ice while crossing a street at a point thirty feet distant from the street crossing, there being no evidence to show that the roughness of the ice caused the injury, the municipality was held not liable. Mueller v. City of Milwaukee (1901) 110 Wis. 623, the court finding it unnecessary to consider the effect upon the case of the passage of ch. 305, Wisconsin Laws of 1899, providing that no action based on the negligent accumulation of ice or snow upon a street shall be maintained unless the same shall have existed for three weeks.

Distinction Between Large and Small Municipalities. In O'Shaughnessy v. Village of Middleport (1904) 93 App. Div. 93, 86 N. Y. Supp. 944, where the plaintiff was injured by slipping on a sidewalk, the question presented was whether negligence can be predicated against a village for not removing snow from crosswalks during the stormy portion of the winter. The court contrasted the difficulties encountered by the authorities in large cities and in smaller municipalities in keeping the streets in a passable condition during winter. "In the large cities of the state, provision is made for the removal of the snow from the streets, and yet, with large sums of money and convenient methods, it is a matter of common knowledge that the larger municipalities are unable to prevent accumulations of snow and ice which lie for days and weeks, despite the greatest efforts to accomplish their removal. In smaller places, and localities where snow storms are more frequent, the removal of snow is impracticable, if not quite impossible, so that such provision must be made for the use of the streets, with the accumulation of snow and ice, as may be practicable and reasonable. As to the sidewalks the snow may be removed, but as the removal of snow from crosswalks would involve a more dangerous condition to the teams and pedestrians than to allow them to remain untouched, as the removal of the snow and ice would form channels, or if ridges in the snow were left simply for the use of teams, the obstruction thus created would be dangerous to pedestrians, it is quite common to find the snow

leveled in the street, and the crosswalks approached either gradually, or kept on a level with the sidewalks."

In the O'Shaughnessy case, it appeared that the crosswalk was kept level with the street, although neither was cleared of snow to the bottom, severe snow storms had covered the ground with snow for several inches, and teams crossing the crosswalk had left some ridges of snow where the runners of the sleighs had passed.

It was held that if a recovery could be sustained under such circumstances, "a village has but small hope of escaping responsibility for injury to any one who may happen to slip upon any of its crosswalks in the winter."

Necessity for Notice to City of Dangerous Condition. There may be proof of a dangerous accumulation of snow, but still the city will not be liable if the evidence does not show that it was there long enough to charge the city with knowledge of the danger. Brennan v. City of New York, supra. See also O'Shaughnessy v. Middleport, supra.

In Eppley v. City of Chicago, 221 Ill. App. 111, it appeared that the step from the sidewalk to the crossing was unusual in its height, being about 14 inches above the level of the roadbed; and that there was an obstruction in the roadway caused by ridges of snow made by vehicular traffic. Plaintiff's account of the accident was that in stepping from the walk to the street she put her right foot down first and on bringing her left foot down, it struck on a piece of ice and threw her. She could not tell the exact piece she fell over; there was testimony that the street was full of lumps of ice below the sidewalk, probably a foot high. It was held that the condition at the place where plaintiff fell had continued for such a length of time as to constitute negligence on the part of the city in not earlier removing the ridges of snow and ice as an obstruction to travel, rendering it liable for plaintiff's injury.

A city would no doubt be liable for injury due to its negligence in failing, after notice and opportunity, to remove ice which had formed from water allowed by a water company to flow on to a street and crosswalk and freeze. Waitemeyer v. Kansas City (1897) 71 Mo. App. 354; or where a city contractor, working under a permit issued by the city, in finding rock bottom in the street by means of a sounding plant, causes such an overflow, resulting in an uneven slippery surface of ice. Loretz v. City of New York (1912) 148 App. Div. 721, 132 N. Y. Supp. 988

Paving in Cook County

The commissioners of Cook County, Illinois, report that during 1923, 50.5 miles of new pavement was completed in that county, 12 miles of it by the state. "Nearly every village in the county is connected by a hard paved road with the county's hard road system. Cook County now has a total of 334.7 miles of paved roads, which exceeds the paved road mileage of every other county in the country."

The department maintained 250 miles, scarifying and rolling 45.1 miles, resurfacing 53.6 miles, oiling 42.6 miles, and filling 64 miles of cracks on concrete roads with bituminous material and repairing 515 sq. yds. of concrete pavement.

Street Paving Tables

The amount of each kind of pavement in use, and that laid last year and the cost of it, in each of nearly five hundred cities. Also details of sidewalk design, including radius of curb corners.

The Questionnaire on city paving sent by us last month to cities throughout the country has been answered by more than five hundred city engineers, with replies still coming in. A large part of these replies is given in the tables on the following pages, but space was not available for presenting replies to all the questions, and we have also omitted those received since the tables were prepared for the printer. Those not published in this issue will appear in a later one.

The data asked for were the total amounts of the several kinds of pavement now on the streets of the city, and the amount and total cost of each kind laid during 1923, with a statement of what items are included in the cost. In the tables the amount is given in square yards unless otherwise stated, some giving their replies in miles (or lineal feet), others in cubic yards of gravel or broken stone. The pavements included sheet asphalt, asphalt concrete, tar concrete, rock asphalt, variations on bituminous concrete such as Warrenite, Willite, National, etc.; asphalt and tar macadam, stone block, brick, creosoted wood block, concrete reinforced and not reinforced, plain macadam, and gravel. Also cement sidewalks.

In addition, information was asked concerning certain details of sidewalk design and practices as to street railway strips. In the matter of sidewalk design the questions asked were: "What is the ordinary width of sidewalk pavement on your business streets?" "On residence streets?" "What radius are you using for curb corners in new construction?" "Are you reconstructing old corners with larger radii?" "Where sidewalk pavements do not occupy the entire width between curb and property line, is it your practice to build them adjacent to the curb?" Replies to these questions from about 450 city engineers are

(Continued on page 71)

SHEET ASPHALT AND BITUMINOUS CONCRETE PAVEMENTS

State and City	Sheet Asphalt: Total area now on streets	Sheet Asphalt: Laid During 1923 Amount	Sheet Asphalt: Laid During 1923 Total cost	Bituminous Concrete: Total area now on streets	Bituminous Concrete: Laid During 1923 Amount	Bituminous Concrete: Laid During 1923 Total cost
Alabama:						
Selma	13,000	.....	.....	.....	.....	.....
Talladega	25,000	.....	.....	.....	.....	.....
Arkansas:						
Fayetteville	.....	.....	.....	70,000	10,000	$28,000(a)
Ft. Smith	.....	.....	.....	6	.....	.....
Texarkana	.....	.....	.....	65,000	.....	.....
California:						
Alameda	.....	.....	.....	113,590	.....	.....
Marysville	26,000	.....	.....	.....	.....	.....
Napa	.....	.....	.....	0.83	.....	.....
Orange	58,080(c)	.....	.....	.....	.....	.....
Palo Alto	64,139	.....	.....	28,830	.....	.....
Pittsburg	.....	.....	.....	40,000	.....	.....
Santa Barbara	5 mi.	.....	.....	26.2 mi.	62,421	132,573(g)
Santa Monica	.....	.....	.....	.....	102,000	21,400
So. Pasadena	50,555	.....	.....	118,980	.....	.....
Vallejo	10,544	.....	.....	9,487	.....	.....
Colorado:						
Denver	535,312	.....	.....	578,773	74,115	174,630
Connecticut:						
Ansonia	.....	.....	.....	0.8	8,834	31,307(g)
Danbury	.....	.....	.....	.....	2,600	5,200
Derby	20,000	.....	.....	700	.....	.....
Bridgeport	12,000	.....	.....	.....	.....	.....
Hartford	563,794	33,226	$98,515(g)	11,441	.....	.....
Meriden	49,278	30,226	60,576	.....	.....	.....
Middletown	47,400	10,000	18,500(g)	.....	.....	.....
Naugatuck	4.27 mi.	.303 mi.	7,657(a)	.786mi.	.116 mi.	2,517(a)
New Britain	27,288(c)	.....	.....	.....	.....	.....
	28,751(d)	.....	.....	47,995(k)	.....	.....
New Haven	574,000	20,000	.....	36,300	.....	.....
Shelton	.....	.....	.....	15,000	.....	.....
Florida:						
Gainesville	.....	80,000(l)	200,000	.....	.....	.....
Illinois:						
Bloomington	110,274	.....	.....	.....	.....	.....
Kewanee	6,940	.....	.....	23,430	.....	.....
Maywood	34,500	.....	.....	.....	.....	.....
Oak Park	17.705	3.751 mi.	373,555(m)	36.23 mi.	.....	.....
Sycamore	2.9 mi.	.....	.....	.....	.....	.....
Indiana:						
Auburn	2.25 mi.	.....	.....	.....	.....	.....
Bicknell	3.0 mi.	.....	.....	.....	.....	.....
East Chicago	3.0 mi.	1.0 mi.	25,000(n)	22.0 mi.	.....	.....
Elkhart	266,184	3,081	13,150(b)	30.960	.....	.....
Fort Wayne	118.7 mi.	13.1 mi.	864,053(m)	.....	.....	.....
Frankfort	.....	.....	.....	0.855 mi.	.....	.....
Gary	201,630	.....	.....	82,350	31,680	69,062(s)
Huntington	6.38 mi.	39,330	93 249	.....	.....	.....
Lafayette	3.19 mi.	.....	.....	.....	.....	.....
Newcastle	60,000	11,000	30,250	.....	.....	.....
Peru	4.48 mi.	22,591	67,547	.....	.....	.....
Richmond	2.102 mi.	0.20 mi.	10,277(g)	.....	.....	.....
Terre Haute	4.36 mi.	.....	.....	1.33 mi.	.....	.....
Vincennes	22.33 mi.	.....	.....	.....	.....	.....
Wabash	10.90 mi.	20,015 (p)	62,668(p)	.....	.....	.....
Warsaw	37,000	23,000	95,000	.....	.....	.....
Washington	59,835	56,335	153,104(g)	.....	.....	.....
Winchester	.....	.....	.....	4,000	4,000	4,000(q)

State and City	Sheet Asphalt: Total area now on streets	Sheet Asphalt: Laid During 1923 Amount	Sheet Asphalt: Laid During 1923 Total cost	Bituminous Concrete: Total area now on streets	Bituminous Concrete: Laid During 1923 Amount	Bituminous Concrete: Laid During 1923 Total cost
Iowa:						
Cedar Rapids	87,516	18,041				
Cherokee	9.5 mi.	.....	36,956	131,155	.....	.....
Eagle Grove	25,000	25,000	.....	1.5 mi.	.....	.....
Oelwein	.....	.....	40,000	25,500	.....	.....
Sioux City	14.5 mi.	27,194	.....	50,000	.....	.....
			89,325	.....	.....	.....
Kansas:						
Emporia	.....	.....				
Herington	.....	.....	.....	214,200	.....	.....
Kansas City	.....	.....	.....	8.0 mi.	.....	.....
Manhattan	139,769	85,101	.....	7.19 mi.	5,659	17,867
Newton	.....	.....	274,828(b)	271,320	.....	.....
Ottawa	.....	.....	.....	301,980	.....	.....
Parsons	.....	.....	.....	27,000	.....	.....
Salina	2.0 mi.	.....	.....	1.38 mi.	.....	.....
			.....	8.0 mi.	.....	.....
Kentucky:						
Covington	96,000	35,000				
			4.25 sq. yd. (y)	.....	.....	.....
Maryland:						
Salisbury	4,400	4,400				
			3,900(s)	13,000	.....	.....
Massachusetts:						
Boston	843,779	.....				
Lowell	23,824	2,180	.....	877,573	.....	.....
Lynn	459,402	76,276	.....	39,536	29,339	.....
Pittsfield	29,375	.....	209,759	3,220	1,987	.....
Westfield	8,211	.....	.....	.....	.....	.....
Worcester	124,060	26,830	.....	.....	.....	.....
			92,940(r)	.....	.....	.....
Michigan:						
Albion	9,300	.....				
Ann Arbor	40,000	18,000	.....	15,500	.....	.....
Battle Creek	113,118	.....	78,540(i)	48,300	.....	.....
Detroit	6,967,255	809,278	.....	131,371	.....	.....
Flint	61.02 mi.	101,136	4,625,233(i)	2,554,442	.....	.....
Hamtramck	125,420	82,714	539,700(t)	3.24 mi.	.....	.....
Holland	94,700	75,000	592,952	.....	.....	.....
Lansing	300,000	80,000	275,000(m)	66,430	.....	.....
Marshall	1.18 mi.	.....	320,000	5.8 mi.	.....	.....
Midland	2.0 mi.	.....	.....	0.95 mi.	.....	.....
Niles	1.0 mi.	.....	.....	2.5 mi.	.....	.....
Owosso	0.08 mi.	.....	.....	1.5 mi.	.....	.....
Pontiac	24,600	13,447	.....	.....	.....	.....
			34,600	119,130	.....	.....
Minnesota:						
Duluth	6.34 mi.	.....	.....	0.10 mi.	.....	.....
Minneapolis	687,773(l)	112,242(l)	398,345(g)	.....	.....	.....
Rochester	.....	.....	.....	67,015	.....	.....
Mississippi:						
Biloxi	30,000	30,000	100,000(u)	.....	.....	.....
Clarksdale	.....	.....	.....	96,000	.....	.....
Greenwood	.....	.....	.....	47,000	.....	.....
Hattiesburg	.....	.....	.....	30,128	.....	.....
Laurel	80,000	.....	.....	.....	.....	.....
Missouri:						
Carthage	20,000	.....	.....	.....	.....	.....
Kansas City	3,780,760(l)	90,418(l)	279,038(g)	.....	.....	.....
St. Joseph	.....	17,042	88,946	.....	80,153	213,079
Springfield	.....	.....	.....	16.2 mi.	.....	.....
Montana:						
Helena	.....	.....	.....	69,622	47,829	159,216(v)

SHEET ASPHALT AND BITUMINOUS CONCRETE PAVEMENTS—(Continued)

State and City	Sheet Asphalt: Total area now on streets	Sheet Asphalt: Laid During 1923 Amount	Sheet Asphalt: Laid During 1923 Total cost	Bituminous Concrete: Total area now on streets	Bituminous Concrete: Laid During 1923 Amount	Bituminous Concrete: Laid During 1923 Total cost
Nebraska:						
Grand Island	287,244	49,203	151,864(i)	.....	.....	.....
Kearney	4.09 mi.	.....	.....	0.3 mi.	69,399	166,441(i)
Lincoln	564,179	53,599	173,500(a)	770,180	125,595	398,700(a)
Norfolk	.....	.....	.....	244,681	35,724	116,000(i)
North Platte	311,000	151,500	480,000(a)	.....	.....	.....
New Jersey:						
Bayonne	40.0 mi.	8.0 mi.	.....	.....	.....	.....
Hammonton	.....	.....	.....	2.25 mi.	.....	.....
Long Branch	10.0 mi.	5.0 mi.	450,000	.....	.....	.....
Newark	1,538,996	271,910	864,900(a)	68,169	38,979	143,600(a)
New Brunswick	203,542	37,742	112,364(h)	.....	.....	.....
Nutley	3 mi.	1 mi.	46,000(g)	.....	.....	.....
Orange	.....	3,678	13,276(g)	.....	.....	.....
Passaic	267,184	29,248	109,047	72,400	61,250	89,636
Plainfield	62,440	24,000	126,000(i)	19,410	.....	.....
Rahway	.4 mi.	.....	.....	4.9 mi.	.....	.....
South Orange	.....	16,000	.....	.....	.....	.....
Trenton	652,366	47,709	246,914(m)	314,066	10,750	23,918(m)
West New York	.....	.....	.....	154,686	2,400	7,500(f)
New York:						
Auburn	77,548	2,574	13,493(b)	.....	.....	.....
Batavia	.....	.....	.....	1.719 mi.	.....	.....
Cortland	50,000	.....	.....	55,000	23,000	65,000(b)
Dobbs Ferry	.....	2,780	6,505	.....	.....	.....
Geneva	70,000	22,000	135,000	16,500	.....	.....
Lockport	30,752	.....	.....	.....	.....	.....
New York (Manhattan Boro)	275 mi.	11.1 mi.	1,397,246	0.9 mi.	0.5 mi.	72,878
Niagara Falls	336,426	25,750	166,639(b)	63,544	.....	.....
Oneonta	.....	.....	.....	2.82 mi.	2.82 mi.	250,000(m)
Rochester	2,752,610	195,144	507,375(f)	.....	.....	.....
Watertown	2.02 mi.	.....	.....	0.38 mi.	.....	.....
North Carolina:						
Asheville	66,505	14,225	.....	220,700	23,015	.....
Charlotte	699,021	185,865	502,321	215,747	60,433	136,929
Durham	20 mi.	60,000	300,000(b)	.....	.....	.....
Monroe	7 mi.	½ mi.	28,000	.....	.....	.....
Wilmington	45,000	5,400	.....	6,847	.....	.....
North Dakota:						
Fargo	.....	.....	.....	88,064	4,018	16,218(b)
Ohio:						
Akron	418.104	183,960	940,865(b)	82,521	.....	.....
Alliance	2 mi.	.....	.....	2 mi.	.....	.....
Bucyrus	8,500	8,500	14,000	.....	.....	.....
Columbus	1,445,000	195,990	947,600	90,000	.....	.....
Conneaut	45,872	30,672	133,641	.....	.....	.....
Dayton	21.66 mi.	.....	.....	.....	.....	.....
Elyria	4.8 mi.	1,120	5,500(b)	0.7 mi.	6,800	34,000(b)
Findlay	7 mi.	60,445	264,636	3 mi.	.....	.....
Galion	10 mi.	19,106	89,554	.....	.....	.....
Girard	.....	.....	.....	16,400	3,000	11,000(m)
Lakewood	.....	.....	.....	38.58 mi.(w)	95,472	499,665(x)
Lancaster	.....	40,000	139,000(b)	.....	.....	.....
Lima	278,803	64,329	313,857(m)	51,736	.....	.....
London	20,000	.....	.....	.....	.....	.....
Lorain	11.78 mi.	.....	.....	8.52 mi.	0.1 mi.	11,421(b)
Mansfield	31,500	27,400	84,400(a)	.....	.....	.....
New Philadelphia	2 mi.	2 mi.	.....	.....	.....	.....
Salem	27,000	14,000	25,000	.....	.....	.....
Sandusky	240,000	.....	.....	.....	.....	.....
Urbana	10,000	.....	.....	.....	.....	.....
Warren	6,582	4,112	23,947(m)	3 mi.	.....	.....
Wisconsin:						
Appleton	13,500	.....	.....	.....	.....	.....
Beloit	262,871(l)	.....	.....	.....	.....	.....
Fond du Lac	44,357	.....	.....	75,425	27,789	.....
Green Bay	444,486	36,428	115,265	8,609	.....	.....
Madison	330,760	16,585	45,600(f)	64,341	.....	.....

(a)—Includes entire pavement; (b)—Entire improvement; (c)—Concrete base; (d)—Macadam base; (e)—Laid on old macadam; (f)—Surface and base; (g)—Grading, base and surface; (h)—Surface, base and curb; (i)—Surface, base, curb and grading; (k)—Amiesite; (l)—Includes asphalt concrete; (m)—Surface, base, grading, curb and sewer work; (n)—Resurfacing; (p)—Of this amount 4,276 sq. yds. was resurfacing at cost of $7,355; (r)—Surface, base, grading, engineer, lighting, etc., but not curb; (q)—69c. to $1.50 per sq. yd. part resurfacing; (s)—Surface only; (t)—Surface, base, grading, drainage, curb, gutter, excavation, engineering and walk repairs; (u)—Surface, base, grading, sewers; (v)—Surface, base, grading, drainage, repairing old curb and sidewalk; (w)—Includes all bituminous pavements; (x)—Grading, base, curb, surface, drain tile; (y)—Grading, base.

ROCK ASPHALT AND BITUMINOUS MACADAM

City and State	Rock Asphalt: Total Area	Rock Asphalt: Laid During 1923 Area	Rock Asphalt: Laid During 1923 Total Cost	Bituminous Macadam: Total Area	Bituminous Macadam: Laid During 1923 Area	Bituminous Macadam: Laid During 1923 TotalCost
Alabama:						
Birmingham	.....	.....	.....	333,675(a)	.....	.....
Arkansas:				18,000(a)	1,100(a)	$2,350(w)
Fayette	.....	.....	.....	¾ mi.	.....	.....
Fort Smith	.....	.....	.....			
California:						
Alameda	.....	.....	.....	1,193,055(a)	1,100(a)	1,386
					92,650(a)	16,575(k)
Glendale	.....	.....	.....	812,166(a)	183,266(a)	182,264(l)
Napa	.....	.....	.....	10.54 mi.(a)	12,000(a)	19,000(p)
Pittsburg	.....	.....	.....	1,400,000(a)	.....	.....
Santa Barbara	.....	.....	.....	4.5 mi.(a)	2,054(a)	4,252(g)
South Pasadena	.....	.....	.....	877,000	367,600	400,000(g)
Vallejo	259,389	.....	.....	57,761(a)	.....	.....
Connecticut:						
Ansonia	.....	.....	.....	.3 mi.(a)	.....	.....
Bridgeport	.....	.....	.....	250,000(a)	110,000(a)	100,000
				50,000(a)	.....	.....
Hartford	.....	.....	.....	7,000(a)	.....	.....
				2,000(t)	.....	.....
Middletown	.....	.....	.....	39,643(a)	.....	.....
Naugatuck	.....	.....	.....	3.45 mi.(a)	2.66 mi.(a)	.....
New Haven	45,400	.....	.....	572,000(a)	.....	.....
Putnam	.....	.....	.....	30,000(a)	2,000(a)	5,000(g)
Illinois:						
Bloomington	.....	.....	.....	800(a)	.....	.....
Cairo	1,500	1,500	.....	.....	.....	.....
Sycamore	.....	.....	.....	0.8 mi.(t)	.....	.....
Waukegan	.....	.....	.....	.....	1,168(a)	3,671(b)
Indiana:						
Anderson	.....	10,300	$31,350(r)	.....	.....	.....
East Chicago	.....	.....	.....	2 mi.(a)	.....	.....
Elkhart	.....	.....	.....	30,073(t)	.....	.....
Fort Wayne	.....	.....	.....	1.2 mi.(a)	.....	.....
				1.7 mi.(t)	.....	.....

Oklahoma:						
Henrietta				36,000	13,000	56,000(f)
Oregon:						
Astoria				2.34 mi.		
Oregon City				30,400		
Portland	2,074,691			1,159,376	121,304	238,421
Salem				179,700	6,396	9,355
Pennsylvania:						
Altoona	38,636			12,838		
Clearfield				0.3 mi.		
Dubois				17,625		
Duquesne		1.51 mi.(n)				
Farrell	2,745					
Lebanon				647(k)		
Luzerne	6,037	6,037	31,670			
Mahanoy City	1 mi.					
Norristown					9,500	25,500(k)
Reading	12.775 mi.	.204 mi.	16,542(g)	5.209 mi.		
Sharon	74,987	34,845	144,963(i)	20,872		
Steelton	14,660					
Williamsport	5 mi.					
Rhode Island:						
Lincoln		1.33 mi.	60,000			
South Carolina:						
Chester	65,500					
Greenville	18,000			25,000	8,000	105,000(m)
Orangeburg	8,500			136,875	41,553	1.92 mi.
South Dakota:						
Madison	20,000					
Sioux Falls				365,409		
Watertown	48,885					
Tennessee:						
Clarksville				65,000		
Jackson	57,000			6,300		
Murfreesboro				25,000		
Nashville	29,481	3,150		35,595		
Texas:						
Houston	90,222			293,322	20,337	65,384(b)
Paris				29,633		
Taylor				163,725		
Utah:						
Salt Lake City	40.158 mi.			9,988		
Vermont:						
Barre				.02 mi.		
Virginia:						
Charlottesville	30,000	30,000	95,000(a)	90,000	90,000	270,000(a)
Danville	73,206			105,769	14,330	50,000
Lynchburg	236,000	19,000				
Petersburg	79,000	46,000	136,000	4,000		
Suffolk				4,000		
Washington:						
Aberdeen	150,000			25,000		
Anacortes	43,650					
Port Angeles				15,894		
Walla Walla	138,679			144,808		
Yakima	55,990			167,041	7,739	29,175
West Virginia:						
Bluefield	41,000	18,466	83,701	39,000	7,480	39,868
Frankfort		.12 mi.			1.50(a)		
Gary					39,000(a)	40,000(a)	110,000
					141,000(t)		
Greensburg					20,000(t)		
Lebanon					16,000(a)		
Peru		.10 mi.	2,548	7,566			
Richmond					.53 mi.(t)	.53 mi.	23,887(g)
Wabash					0.43 mi.(t)		
Washington		21,245	21,245	33,560(g)			
Iowa:							
Cedar Rapids					97,600(t)		
Kansas:							
Kansas City		43.11 mi.(s)	126,719	369,893	.50 mi.(a)	1,646(a)	5,879
Ottawa					7,000(t)		
Parsons					1 mi.(t)		
Kentucky:							
Bowling Green		150,000	40,000				
Covington		20,000				2,000(a)	6,000(b)
Maine:							
Augusta						7,222(t)	7,479(f)
Maryland:							
Salisbury					11,000(a)		
					86,000(t)		
Massachusetts:							
Andover					20 mi.(t)	7,000(a)	10,500
Brockton						25,872(a)	50,000
Gardner						14,000(t)	
Lee						½ mi.(t)	11,000(i)
Lowell					71,618(a)	12,658	
					193,417(t)		
Newton					210,000(a)		
Pittsfield					46,400(a)	3,825	14,535(x)
Reading					5 mi.(t)	½ mi.(t)	98c per sq. yd.
Southbridge					200,000(t)		
Westfield					14.8 mi.(a)	0.17 mi.(a)	
Worcester					385,562(t)	6,250(t)	14,708(b)
Michigan:							
Dowagiac					6,000(t)		
Ironwood					135,000(t)	19,000	30,000
Marquette					7½ mi.(a)	2 mi.(a)	
Marshall					0.53(t)		
Munsing					100,000(a)	60,000(a)	60,000
Owosso					20 mi.(o)		
Pontiac					7,900(a)		
Minnesota:							
Duluth					6.53mi.(t)		
Hibbing					28,300(t)		
Minneapolis					298,427 (a&t)		
Red Wing					14,000(t)		
Mississippi:							
Biloxi		12,000					
Clarksdale		2,000	2,000	2,500(e)			
Greenwood					14,900(a)		
Missouri:							
Boonville					19,000(a)		
					22,000(t)	5,000(t)	75,000
Columbia					4 mi.(a)		
Fulton					2,880(t)		
Joplin					30,000(a)		
Kansas City					1,243,575(a)	64,812(a)	138,078(u)
Monett					5,000(a)		
					25,000(t)		

ROCK ASPHALT AND BIT. MACADAM—(Continued)

City and State	Rock Asphalt: Total Area	Rock Asphalt: Laid During 1923 Area	Rock Asphalt: Laid During 1923 Total Cost	Bituminous Macadam: Total Area	Bituminous Macadam: Laid During 1923 Area	Bituminous Macadam: Laid During 1923 Total Cost
Missouri (Continued)						
Nevada	.....	.....	.....	4 mi.(a)	.....	.....
St. Joseph	.....	.....	.....	.....	12,783(a)	15,597
Sedalia	1½ mi.	.....	.....	3 mi.(a)	.....	.....
Springfield	0.1 mi.	.....	.....	6.0 mi.(a)	.....	.....
Montana:						
Kalispell	.....	.....	.....	29,464(a)	.....	.....
New Jersey:						
Englewood	.....	.....	.....	23 mi.(a) 1 mi.(t)	104,029(a)	135,237
Newark	.....	.....	.....	3,088(t)	.....	.....
Newton	.....	.....	.....	11,000(a) 39,700(t)	2,500(a) 12,400	4,200(e) 6,000(e)
Nutley	.....	.....	.....	3.5 mi.(t)	1.5 mi.(t)	25,000(g)
Orange	.....	.....	.....	11,234(a)	5,578(a) 1,195(t)	6,500(k) 2,567(g)
Passaic	.....	.....	.....	201,568(a)	39,868(a)	55,800
Plainfield	.....	.....	.....	136,300(t)	23,650(t)	75,000(l)
Prospect Park	.....	.....	.....	5,000(t)	.....	.....
Rahway	.7 mi.	.....	.....	11 mi.(t)	.....	.....
South Orange	.....	.....	.....	.....	18,000(a)	.....
Summit	.....	.....	.....	2.5 mi.(a&t)	.....	.....
Trenton	.....	.....	.....	.....	162,050(a)	15,850(j)
New York:						
Auburn	.....	.....	.....	10,000(a) 26,184(t)	.....	.....
Corning	.....	.....	.....	12,608(a)	.....	.....
Cortland	.....	.....	.....	50,000(a)	.....	.....
Geneva	.....	.....	.....	51,921(a) 3,025(t)	.....	.....
Hempstead	.....	.....	.....	.....	18,797	67,481
Little Falls	.....	.....	.....	12,102(t)	.....	.....
Niagara Falls	.....	.....	.....	51,515	.....	.....
Ogdensburg	.....	.....	.....	6,624(a)	6,624(a)	.....
Oneonta	.....	.....	.....	2.3 mi(a) .5 mi.(t)	.....	.....
Perry	.....	.....	.....	37,790(t)	.....	.....
Saranac Lake	.....	.....	.....	66,400(a)	12,500(a)	.....
Watertown	.....	.....	.....	2.33mi.(a)	.....	.....
North Carolina:						
Charlotte	.....	.....	.....	52,308(a)	.....	.....
Durham	.....	.....	.....	15 mi.(a)	.....	.....
Wilmington	.....	.....	.....	107,000(a)	.....	.....
Ohio:						
Columbus	.....	.....	.....	100,000 (t&a)	.....	.....
Conneaut	1,600	.....	.....	.....	.....	.....
Dayton	0.52 mi.	3,675	11,025	5.98 mi.(a)	2,500	5,875
Elyria	.....	.....	.....	3.4 mi.(a&t)	.....	.....
Findlay	.....	.....	.....	.3 mi.(t)	.....	.....
Lima	.....	.....	.....	65,827	.....	.....
Mansfield	.....	.....	.....	38,700(t)	.....	.....
Urbana	.....	.....	.....	6,000(t)	2,300(t)	7,800(b)
Oklahoma:						
Ardmore	6.77 mi.	.09 mi.	.....	1.79 mi.(a)	.....	.....
Bartlesville	.....	.....	.....	13,600(t)	.....	.....
Henrietta	3,450	3,450	13,800(f)	.....	.....	.....
Lawton	10 mi.	.....	.....	.....	.....	.....
Oregon:						
Marshfield	72,620	.....	.....	.....	.....	.....

STONE BLOCK AND BRICK PAVEMENT

City and State	Stone Block: Total Area	Stone Block: Laid During 1923 Area	Stone Block: Laid During 1923 Total Cost	Brick or Clay Block: Total Area	Brick or Clay Block: Laid During 1923 Area	Brick or Clay Block: Laid During 1923 Total Cost
Alamaba:						
Selma	.....	.....	.....	7,000	15,000	$45,000
Arkansas:						
Fort Smith	.....	.....	.....	54 mi.	.....	.....
Texarkana	.....	.....	.....	22,000	22,000	80,000
California:						
Marysville	400	.....	.....	.....	.....	.....
Vallejo	1,033	.....	.....	2,017	.....	.....
Colorado,						
Denver	147,205	.....	.....	10,810	.....	.....
Connecticut:						
Ansonia	1.3 mi.	.....	.....	.....	.....	.....
Bridgeport	25,000	.....	.....	75,000	8,000	24,000
Derby	5,550	.....	.....	.....	.....	.....
Hartford	31,496	.....	.....	1,212	.....	.....
Meriden	.....	.....	.....	38,220	4,350	19,096
Naugatuck	.....	.....	.....	.338	.....	.....
New Britain	.....	.....	.....	10,570	905	3,392(b)
New Haven	36,100	.....	.....	76,000	.....	.....
Shelton	2,500	.....	.....	.....	.....	.....
Florida:						
St. Petersburg	.....	.....	.....	1,250,000	85,000	390,000
Illinois:						
Benton	.....	.....	.....	3 mi.	.....	.....
Bloomington	.....	.....	.....	239,229	36,523	152,576
Cairo	350	350	.....	150,000	1,500	.....
Canton	.....	.....	.....	158,000	2,200	8,900
Clinton	.....	.....	.....	6 mi.	.....	.....
Collinsville	.....	.....	.....	4 mi.	.....	.....
Galena	.....	.....	.....	50,000	.....	.....
Johnson City	.....	.....	.....	.....	58,188	33,697(a)
Kewanee	.....	.....	.....	20,085	.....	.....
Marion	.....	.....	.....	.....	2,617	14,771
Maywood	.....	.....	.....	440,000	.....	.....
Normal	.....	.....	.....	173,116	8,000	40,000
Oak Park	.....	.....	.....	15.369 mi.	1.329 mi.	237,151(g)
Sycamore	.....	.....	.....	1.0 mi.	.....	.....
Waukegan	570	.....	.....	.....	.....	.....
Indiana:						
Anderson	.....	.....	.....	.....	1,332	5,500(k)
Auburn	.....	.....	.....	½ mi.	.....	.....
Bicknell	.....	.....	.....	1 mi.	.....	.....
Brazil	.....	.....	.....	95,000	1,000	4,000
Connersville	.....	.....	.....	33,775	.....	.....
Decatur	.....	.....	.....	7 mi.	.....	.....
East Chicago	.....	.....	.....	7 mi.	.....	.....
Elkhart	.....	.....	.....	225,940	9,680	44,000(a)
Ft. Wayne	.....	.....	.....	29.4 mi.	.....	.....
Frankfort	13.94 mi.	.....	.....	13.67 mi.	.....	.....
Gary	.....	.....	.....	332,600	.....	.....
Greensburg	.....	.....	.....	20,000	.....	.....
Huntington	.....	.....	.....	7.62 mi.	.....	.....
Lafayette	.....	.....	.....	12.30 mi.	.07 mi.	4,580
Lebanon	.....	.....	.....	110,000	3,500	.....
Newcastle	.....	.....	.....	60,000	.....	.....
Peru	.....	.....	.....	2.05 mi.	2,463	9,828
Richmond	.....	.....	.....	7.288 mi.	.....	.....
Rushville	.....	.....	.....	3½ mi.	.....	.....
Terre Haute	.....	.....	.....	40.09 mi.	.....	.....
Wabash	.....	.....	.....	0.68 mi.	.....	.....
Warsaw	.....	.....	.....	100,000	.....	.....
Washington	.....	.....	.....	3 mi.	2,901	10,705(d)
Winchester	.....	.....	.....	8 mi.	.....	.....
Iowa:						
Cedar Rapids	.....	.....	.....	764,871	5,396	21,098
Decorah	.....	.....	.....	1½ mi.	.....	.....
Keokuk	.....	.....	.....	6.33 mi.	.....	.....

Pennsylvania:						
Chambersburg				.9 mi.(t)		
Downington				14,600(a)	2,000(a)	2,168
Farrell				24,000(t)		
Lansdowne				8 mi.(t)		
Middletown				800,000(t)	264,400(t)	13,808(g)
Norristown				7.90 mi.(t)		
Reading				1.350 mi.(a)		
Sayre				4,000(t)		
Sewickley				3 mi.(t)	2,000(t)	2,800(w)
Sharon				5,774(a)		
Shippensburg				30,000(a)	20,000(a)	
South Williamsport				6 mi.(a)	5 mi.(a)	
South Carolina:						
Chester				6,000(a)		
Greenville				5,000(t)	2,000(t)	8,000(j)
Tennessee:						
Jackson	20,800					
Kingsport				11,000(t)		
Murfreesboro	35,000	15,000				
Nashville	55,497	111,340		41,257(a)		
				61,896(t)		
Union City	6,000	6,000	4,578			
Texas:						
Cisco				4,700(a)	3,573(a)	4,366
Houston	262,348	86,971	253,373(w)	46,297(a)	35,243(a)	23,762(w)
Longview				5 mi.(a)		
Paris	48,201			13,298(a)		
Taylor	22,182					
Utah:						
Salt Lake City	11.017 mi.			1,305(t)		
Vermont:						
Barre				5,332(a&t)		
Virginia:						
Danville				6,939(a)		
				8,467(t)		
Harrisonburg				33,000(t)		
Petersburg				6,000(a)		
Salem				3 mi.(a)		
Suffolk	5,154	5,154	5,669.40	3,470(a)		
				13,200(t)		
Winchester				203,700(t)	1½ mi.(t)	
					1½ mi.(a)	
West Virginia:						
Bluefield				116,000(t)	3,165(t)	12,388(b)
Fairmont	2,900	3,000	4,500(l)			
Wisconsin:						
Antigo				3,000(t)		
Baraboo				94,000(t)	12,000(t)	14,450
Fond du Lac				14,615(t)		
Green Bay				38,551(t)		
Kaukauna				26,029(t)	7,976(t)	7,418(g)
Madison				130,159(a)		
				28,144(t)		
Wausau				20,000(a)		
				60,000(t)		

(a)—Asphalt macadam. (b)—Includes entire improvement. (c)—Concrete base. (d)—Macadam base. (e)—Laid on old macadam. (f)—Surface and base. (g)—Grading, base and surface. (h)—Surface, base and curb. (i)—Surface, base, curb and grading. (j)—Surface, base, grading, curb and sewer work. (k)—Resurfacing. (l)—Surface only. (m)—Surface, base, grading, drainage, curbs, gutters, excavation, engineering and walk repairs. (n)—Surface, base, grading, sewers. (o)—Oil macadam. (p)—Grading, curbing and paving. (r)—Surface, base, grading, curb, sidewalks, sewers. (s)—Includes sheet asphalt. (t)—Tar macadam. (u)—Surface, base, subgrade. (v)—Grading, base. (w)—Includes entire pavement. (x)—Surface and grading.

Le Mars				21,758		
Oelwein				21,500		
Sioux City				10.60 mi.		
Kansas:						
Emporia				180,000	22,000	120,000(a)
Independence				31 mi.	½ mi.	
Kansas City	.10 mi.			62.81 mi.	11,284	94,886
Manhattan				88,100		
Newton				13,220		
Ottawa				318,000	26,000	118,000
Parsons				7.95 mi.		
Salina				32 mi.	85,000	275,000
Kentucky:						
Ludlow				10,000		
Louisiana:						
Baton Rouge				2 mi.		
Maine:						
Augusta	10,667					
Rockland		1,820	$5,821(1)			
Maryland:						
Salisbury	11,000					
Massachusetts:						
Boston	1,297,079			114,076		
Brockton		106	475			
Great Barrington				1,150 ft.		
Lowell	419,810	23,027		898		
Lynn	128,818	20,066	50,000			
Pittsfield				72,579	1,350	7,800(m)
Southbridge	1,800			25,000		
Westfield	29,656			1,212		
Worcester	379,665	2,360	14,860(b)	12,418		
Michigan:						
Albion				10,000		
Ann Arbor				55,300		
Battle Creek				288,499		
Detroit	316,554			1,690,894		
Dowagiac				25,000		
Flint				14.18 mi.	813	6,000(b)
Greenville				6 blocks		
Hamtramck				8,200		
Holland				42,700		
Lansing				5 mi.		
Marshall				0.41 mi.		
Mt. Pleasant				12,000		
Niles				3 mi.		
Owosso				3.50 mi.		
Pontiac				52,900		
Minnesota:						
Duluth	6.65 mi.	.06 mi.	11,600	8.35 mi.		
Faribault	.13 mi.			.62 mi.		
Minneapolis	382,855	17,103	106,410(d)	578,078	66,180	329,650(d)
Red Wing	3,825			3,883		
Rochester				51,293		
Stillwater	6,377			9,625		
Mississippi:						
Biloxi				40,000	10,000	40,000(j)
Greenwood				46,000	46,000	168,000
Hattiesburg				26,967	9,509	
Laurel				50,000	25,000	
Missouri:						
Cape Girardeau				3 blocks		
Columbia				15 mi.	¼ mi.	
Fulton				17,780		
Kansas City	136,472			905,218	46,293	198,626(d)
Maplewood				6,868		
Monett				30,000		
Nevada				1 mi.		
St. Joseph					10,069	46,343
Sedalia				14 mi.		
Springfield				9.23 mi.		
Montana:						
Butte	1.014 mi.			1.2 mi.		
Helena				2 mi.		

STONE BLOCK AND BRICK PAVEMENT (Continued)

State and City	Stone Block: Total area now on streets	Stone Block: Laid During 1923 Amount	Stone Block: Laid During 1923 Total cost	Brick or Clay Block: Total area now on streets	Brick or Clay Block: Laid During 1923 Amount	Brick or Clay Block: Laid During 1923 Total cost
Nebraska:						
Fairbury	.....	.....	.....	67,400	36,000	140,000(a)
Fremont	.....	.....	.....	182,000	.....	.....
Grand Island	.....	.....	.....	169,153	2,316	9,108(n)
Kearney	.....	.....	.....	½ mi.	.....	.....
Lincoln	.....	.....	.....	628,435	4,539	17,900(b)
Norfolk	.....	.....	.....	22,483	.....	.....
North Platte	.....	.....	.....	50,000	5,000	21,000(b)
New Jersey:						
Bayonne	4 mi	⅜ mi		½ mi.	.....	.....
Newark	1,631,535	23,600	206,300(a)	1,018,446	.....	.....
New Brunswick	20,000	.....	.....	13,000	.....	.....
Nutley	1 mi.	.....	.....	.....	.....	.....
Passaic	1,334	.....	.....	9,184	.....	.....
Plainfield	27,510	3,700	.....	55,937	.....	.....
Rahway	.....	.....	.....	2.1 mi.	.....	.....
Summit	0.2 mi.	.....	.....	1.1 mi.	.....	.....
Trenton	113,279	17,921	83,241(b)	152,099	3,825	.....
West New York	17,250	.....	.....	26,690	.....	.....
New York:						
Auburn	6,866	.....	.....	100,916	.....	.....
Batavia	.....	.....	.....	5,029 mi.	.....	.....
Corning	4,400	.....	.....	147,414	.....	.....
Cortland	.....	.....	.....	45,000	2,000	9,500(a)
Dobbs Ferry	2 mi.	.....	.....	0.47 mi.	.....	.....
Geneva	3,500	.....	.....	170,200	.....	.....
Ithaca	.....	.....	.....	11.18 mi.	.....	.....
Little Falls	6,794	.....	.....	41,356	.....	.....
New York (Manhattan Boro)	131.7 mi.	3.8 mi.	1,310,888	.....	.....	.....
Niagara Falls	2,115	.....	.....	239,749	23,340	165,005(a)
Norwich	520	.....	.....	55,325	.....	.....
Ogdensburg	.....	.....	.....	52,800	.....	.....
Oneida	.068 mi.	.....	1,300(b)	3.25 mi.	.....	.....
Oneonta	.....	.....	.....	3.0 mi.	.....	.....
Port Jervis	432,604	4,000	17,880(c)	42,470	1,617	6,900(c)
Rochester	.....	.....	.....	1,144,787	.....	.....
Saranac Lake	.027 mi.	.....	.....	17,000	.....	.....
Watertown	.....	.....	.....	3.8 mi.	.....	.....
North Carolina:						
Asheville	40,100	.....	.....	129,480	.....	.....
Durham	30,000	10,000	80,000(e)	50,000	5,000	20,000(e)
Wilmington	55,000	.....	.....	165,000	.....	.....
North Dakota:						
Fargo	.....	.....	.....	80,008	6,209	30,485(a)
Ohio:						
Akron	93,504	.....	.....	2,130,422	101,348	591,183(a)
Alliance	.....	.....	.....	31 mi.	½ mi.	15,000(g)
Ashtabula	14,167	.....	.....	244,375	328	2,700
Bellefontaine	.....	.....	.....	.....	1,108	4,155
Bucyrus	.....	.....	.....	18 mi.	700	3,200
Cleveland	.....	7,680	50,100	118,792	4,870	26,100(e)
Columbus	294,000	.....	3,532,000	1,542,068	23,980	81,180
Conneaut	.....	.....	.....	.....	.....	.....
Dayton	2.55 mi.	2,650	13,250	59.34 mi.	31,829	124,100
Delaware	.....	.....	.....	7 mi.	.....	.....
East Youngstown	.....	.....	.....	78,000	.....	.....
Elyria	.....	.....	.....	18 mi.	10,800	106,000(a)
Findlay	.....	.....	.....	16.5 mi.	.....	.....
Gallon	.....	.....	.....	10 mi.	7,213	35,000
Girard	.....	.....	.....	106,710	.....	.....
Hillsboro	2.06 mi.	.....	.....	2,808	.....	.....
Lakewood	.....	.....	.....	34.47 mi.	21,934	112,008(b)
Lima	.....	.....	.....	514,582	.....	.....
London	.....	.....	.....	50,000	.....	.....
Lorain	.....	.....	.....	9.33 mi.	19,500	102,400(p)
Mansfield	3,500	.....	.....	563,000	.....	.....
Napoleon	.....	.....	.....	90,000	.....	.....

State and City	Stone Block: Total area now on streets	Stone Block: Laid During 1923 Amount	Stone Block: Laid During 1923 Total cost	Brick or Clay Block: Total area now on streets	Brick or Clay Block: Laid During 1923 Amount	Brick or Clay Block: Laid During 1923 Total cost
Virginia (Continued)						
Lynchburg	.....	.....	.....	10,000	.....	.....
Petersburg	.....	.....	.....	21,000	.....	.....
Suffolk	.....	.....	.....	3,000	.....	.....
Winchester	.....	.....	.....	.....	.....	.....
Washington:						
Aberdeen	.....	.....	.....	.....	.....	.....
Yakima	.....	.....	.....	.....	.....	.....
West Virginia:						
Bluefield	.....	.....	.....	.....	.....	.....
Clarksburg	.....	.....	.....	.....	.....	.....
Fairmont	.....	.....	.....	.....	.....	.....
Wisconsin:						
Appleton	9,200	.....	.....	.....	.....	.....
Baraboo	.....	.....	.....	.....	.....	.....
Beloit	.....	.....	.....	.....	.....	.....
Fond du Lac	.....	.....	.....	.....	.....	.....
Green Bay	2,091	.....	.....	.....	.....	.....
Madison	866	.....	.....	.....	.....	.....
Marinette	.....	.....	.....	.....	.....	.....
South Milwaukee	.....	.....	.....	.....	.....	.....
Wausau	.....	.....	.....	.....	.....	.....
Wisconsin Rapids	.....	.....	.....	.....	.....	.....

State and City	Brick or Clay Block: Total area now on streets	Brick or Clay Block: Laid During 1923 Amount	Brick or Clay Block: Laid During 1923 Total cost
Virginia (Continued)			
Lynchburg	82,000	2,000	.....
Petersburg	28,000	8,200	8,700
Suffolk	35,296	9,000	76c.sq.yd.(u)
Winchester	30,870	.....	.....
Washington:			
Aberdeen	12,000	.....	.....
Yakima	74,902	.....	.....
West Virginia:			
Bluefield	17,700	.....	.....
Clarksburg	19 mi.	11,640	86,556(g)
Fairmont	332,000	503	1,903(n)
Wisconsin:			
Appleton	1,200	.....	.....
Baraboo	4,000	.....	.....
Beloit	166,630	.....	.....
Fond du Lac	83,698	.....	.....
Green Bay	4,027	.....	.....
Madison	39,287	.....	.....
Marinette	41,000	.....	.....
South Milwaukee	1 mi.	.....	.....
Wausau	720,000	.....	.....
Wisconsin Rapids	20,000	.....	.....

(a)—Includes entire pavement; (b)—Includes entire improvement; (c)—surface & base; (d)—surface, base & grading; (e)—surface, base & curb; (f)—surface, base, curb & grading; (g)—surface, base, curb, grading & sewers; (h) resurfacing; (i)—surface only; (j)—surface, base, grading, sewers; (k)—surface, base, grading, curbs & sidewalks; (l)—surface, grading, sewers & engineering; (m)—surface & grading; (n)—surface, base, curb & gutter; (p)—all except sidewalks; (r)—old brick; (s)—new brick on slag base; (t)—surface, grading, curb, gutter & sewers; (u)—relaid.

(Continued from page 64)

given in the last table in this issue. A synopsis of the replies also is given, together with information at greater length from several engineers, in the leading article this month.

The questions concerning the street railway strips were: "Which lays the paving between rails—the city or the street railway company?" "Which pays for it?" "Is the same material used between rails as on the rest of the street?" "If different materials are used, is a header or other separating material placed between them?" Replies to these questions have not yet been tabulated, but this information will be given and discussed in a later issue.

It has been several years since we have published figures for the total area of pavement in the various cities, but a number of readers have asked that this information be obtained. A comparison of the relative amounts of each kind of pavement in any given city with the amounts of the several kinds laid last year will give an indication of the present ideas as to what paving material is desirable as compared to those which prevailed in the past, when the older pavements were being laid.

In connection with the costs given of pavements laid last year, the informants' explanations of the items included, as given in the foot notes, must be carefully noted. In some cases the cost includes only a new surface on an old base; in others, not only base and excavation but also curbs, catch basins, sewer connections and other details of the street improvement are included.

Fees on Pennsylvania Highways

The Department of Highways of Pennsylvania has established a system of fees which became effective February 18th for use of the state highways for various purposes, these fees covering only the actual cost of issuing the permits and making the necessary inspection of the work performed.

Where it is necessary to cut into the surface of an improved road, payment will be demanded in advance for the estimated cost of restoring the pavement, which restoration will be done under the direct supervision of the maintenance force of the department.

Some of the fees to be charged are: For poles for stringing wires, $5.00 for the first five poles and a sliding scale thereafter. Pipes and conduits for water, oil, telephone wires, etc., any length up to 500 feet, $10; pipe line crossings, $5.00. Openings for service pipe connections, $2.00. Moving buildings, $5.00 a building. Gasoline pumps, $5.00 each. The payment in advance for restoring broken pavement surfaces is $9.00 a square yard of surface.

Streets and Railroads

In general there would not seem to be much connection between these two, but in an address before the Transportation Conference in Washington in January, Secretary Hoover said that "One of the most difficult problems in the future development of transportation is that of the railway and water terminals. The expansion of terminal facilities at our larger centers in the next twenty years will be required to a degree that seems almost hopeless with the present methods of terminal distribution and collection. Nor is the problem one solely of increased trackage and shed facilities. It is a problem that affects congestion in the streets and ramifies in a hundred directions in our municipal life. The experimental work being carried out in terminal distribution by coordination with motor truck service, the possible invoicing of goods for store delivery and collection, the establishment of distribution terminals outside congested areas for this purpose—all give such promise as warrant a definite program of constructive experimental development."

The amount of freight carried by our railroads is increasing yearly, and practically all of it is either loaded or delivered or both in a city, and much of it is hauled through the streets. The minimizing of the amount hauled (as by providing direct transfer between ships and cars) and length of haul and providing roadways adequate in width and construction are important features that must receive more attention from city planners and engineers in the future than they have in the past. There are arguments in favor of providing separate routes for much of the heavy trucking in cities, and confining it to them, both because it requires special paving and also because it displays the speed of other traffic and so reduces the volume of traffic that the streets can carry.

Newark	......	700	2,000(a)	......	......	......
New Philadelphia	......	......	......	10 mi.	......	......
New Boston	......	......	......	3½ mi.	......	......
Urbana	......	......	......	70,000	......	......
Warren	......	......	......	35 mi.	1.84 mi.	......
Wooster	......	......	......	300,000	400	7,500
Zanesville	......	......	......	33 mi.	......	......
Oklahoma:						
Ardmore	......	......	......	7.62 mi.	3.12 mi.	228,988(n)
Bartlesville	......	......	......	113,590	......	......
Blackwell	......	......	......	196,500	12,000	......
Henrietta	......	......	......	124,320	8,000	32,000(c)
Oregon:						
Astoria	......	......	......	.81 mi.	......	......
Portland	381,131	......	......	169,404	......	......
Pennsylvania:						
Altoona	16,857.9	......	......	704,801	11,135	65,071(a)
Bangor	......	......	......	......	4,655	......
Berwick	1,600	......	......	75,000	......	......
Chambersburg	......	......	......	1 mi.	......	......
Clairton	......	......	......	102,000	......	......
Clearfield	......	......	......	6 mi.	......	......
College Hill	......	......	......	17,200	......	......
Dubois	......	......	......	114,810	......	......
Duquesne	1.33 mi.	......	......	7.66 mi.	......	......
Farrell	......	......	......	158,000	......	......
Franklin	......	......	......	204,745	400	2,700(n)
Freeland	......	......	......	19,500	......	......
Greensburg	1,268	1,268	7,926	21,624 mi.	7,088	27,220
Homestead	......	......	......	293,000	3,530	9,531(c)
Kane	......	......	......	2 mi.	.017 mi.	19,000
Lebanon	......	......	......	1,012	......	......
Luzerne	......	......	......	1.2 mi.	......	......
Mahanoy City	......	......	......	2½ mi.	......	......
Monongahela	......	......	......	128,574	10,400	57,000
New Brighton	......	......	......	160,000	1,700	9,800
New Castle	......	......	......	27.28 mi.	......	......
North Braddock	......	......	......	585,000	......	......
Pittston	......	......	......	125,145	2,385	15,299(a)
Rankin	5,000	......	......	68,000	4,000	16,600(m)
Reading	1.21 mi.	......	......	10.097 mi.	......	......
Sayre	......	......	......	1 mi.	......	......
Scottdale	......	......	......	70,000	......	......
Scranton	5.153 mi.	10,291	......	6.401 mi.	1,428	......
Sewickley	......	......	......	4 mi.	......	......
Sharon	......	......	......	159,636	4,563	22,941(f)
South Williamsport	......	......	......	1½ mi.	......	......
Susquehanna	......	......	......	3 mi.	21,000	140,000
Uniontown	......	......	......	......	1,500	8,223(e)
Williamsport	......	......	......	15.1 mi.	5,000	17,500
South Carolina:						
Greenville	900	......	......	25,000	......	......
Orangeburg	......	......	......	26,029	......	......
South Dakota:						
Sioux Falls	37,673	......	......	......	......	......
Watertown	......	......	......	1,986	......	......
Tennessee:						
Jackson	......	......	......	55,500	......	......
Nashville	159,750	30,500	......	127,900	......	......
Texas:						
Brownwood	......	......	......	24,000	......	......
Cisco	......	......	......	110,000	40,500	771,035
Ennis	......	......	......	35,000	5,000	22,000(a)
Houston	1,768	......	......	80,042	8,616	31,685(b)
Longview	......	......	......	1 mi.	......	......
Paris	......	......	......	37,936	......	......
Utah:						
Salt Lake City	2.79 mi.	......	......	......	......	......
Vermont:						
Barre	1.01 mi.	......	......	......	......	......
Virginia:						
Charlotte	......	......	......	44,000	4,000	24,000(a)
Danville	27,162	......	......	39,104	......	......

SIDEWALK DETAILS

State and City	Width of Sidewalk — Pavement — Business Streets	Residence Streets	Radius of Curb Corner Now used	Reconstructing Old Corners?
Alabama:				
Birmingham	12	4	10	Some
Florala	10	5	5	Yes
Selma	15-20	6 & 7	15	Yes
Sheffield	10	5	5-10	No
Talladega	8 & 10	4	....	....
Troy	12	5	4	Yes
Arizona:				
Clifton	8	....	3-5	Yes
Arkansas:				
Fayetteville	10	4	15	No
Ft. Smith	10 & 17	....	15	No
California:				
Alameda	16	5 & 6	12-16-20	Some
Fresno	14	5	12	No
Glendale	12	5	25	Yes
Hawthorne	12	5	10	Some
Marysville	12	6	Square	....
Napa	10	6	10	No
Orange	6-10	5	8	Not yet
Palo Alto	12	5	12	Yes
Pittsburg	10	12	Sidewalk width	Yes
Redwood	12-15	5	15	Few
Santa Barbara	12	6	12	No
Santa Monica	10	5	12	Yes
South Pasadena	10	5	12 & up	Yes
Vallejo	14	6	20	No
Colorado:				
Colorado Springs	16	4 & 6	10	No
Denver	16	15-25	15	....
Longmont	16	4 & 5	15	Few
Loveland	12	4	13	Yes
Connecticut:				
Ansonia	12	7	12 or more	Yes
Bridgeport	10-15	9	Sidewalk width	Yes
Bristol	8	5	10	....
Danbury	12-25	8-10	Various	Yes
Derby	12	10	10 or more	No
Hartford	15	6	10 or more	Yes
Meriden	12-15	5	10	Yes
Middletown	20	4	6-8	No
Naugatuck	10	6	Sidewalk width	No
New Britain	12	5	15 & 9	Yes
New Haven	....	....	10 or more	Some
Putnam	8	6	6	Few
Shelton	12	9	10 or more	Yes
Florida:				
Daytona	10	5	28	Yes
Gainesville	15	5-7	10	No
Jacksonville	10-15	4 & 6	20	Yes
St. Petersburg	10	6	15	Yes
Georgia:				
Lagrange	14	5	12	Yes
Idaho:				
Idaho Falls	12	6	9	....
Pocatello	10	6	4	No
Illinois:				
Benton	7	4	12	No
Bloomington	12	5	10	Yes
Cairo	10-16	6	8	No
Canton	12	5	12 or more	Yes
Clinton	4-16	3-5	....	....
Collinsville	6-18	4 & 5	8	No
Galena	8	3-6	....	....
Granite City	36	....	18	Yes
Johnson City	12	4	12	Yes
Kewanee	14	4 & 5	15	No
La Grange	16	5' 4"	15	Some
Marion	8	4½	12-30	Yes
Maywood	12	5' 4"	12-20	Few
Normal	10	4-5	10-20	No
Oak Park	10	5' 4"	15	Yes
Pana	10	5	20	....
Sycamore	12	4	16	Yes
Waukegan	14	5' 4"	15	No
Zion	6 & 12	5	20 & 25	....
Indiana:				
Anderson	10-14	5	12	Yes
Bicknell	12	4½	10	Yes
Brazil	13	5	9	Yes
Connersville	13	5	8	No
Decatur	14	5	4	....
East Chicago	12	6	6-10	No
Elkhart	6-10	5	12 or more	Yes
Fort Wayne	10-12	5-6-8	12-25	Yes
Frankfort	15	6	Sidewalk width	Yes
Gary	12-17	5	15	Yes
Greensburg	9	5	....	Yes
Huntington	12	5 & 6	10 & 12	Yes
Lafayette	10	5 & 6	6	No
Lebanon	10	5 & 6	8 (res.)	No
Newcastle	12	5	12	Yes
Peru	20	5	6	Yes
Portland	8	4	8	....
Richmond	14	6	12	Yes
Rushville	13	5	5-12	Yes
Terre Haute	15	5	12 & 15	No
Vincennes	8	5	6	No
Wabash	12	5 & 6	12	Yes
Warsaw	12	5	8	No
Washington	10 & 12	4-6	6	....
Winchester	16	5	6-10	Some

SIDEWALK DETAILS

State and City	Width of Sidewalk — Pavement — Business Streets	Residence Streets	Radius of Curb Corner Now used	Reconstructing Old Corners?
Iowa:				
Ames	10-13	4-6	18	Some
Cedar Rapids	16-20	5	9 or more	Some
Cherokee	13	5' 3"	....	No
Decorah	12	5½	16-25	Yes
Eagle Grove	16	5	18	Few
Keokuk	17	5	5-10	Yes
Le Mars	12	5	12	....
Muscatine	10	4 & 5	16	Some
Oelwein	10-12	4, 5 & 6	15-25	Expect to
Sioux City	14	4 & 5	Various	Some
Kansas:				
Augusta	16	5	15	No
Emporia	16	4	15	....
Herington	12	4-6	3-6	No
Independence	16	4 & 5	10	No
Kansas City	5	....	10	Yes
Manhattan	9-16	5-7	12-15-20	Yes
McPherson	18	4	15	No
Newton	16	4-6	....	....
Ottawa	14	5	15	Some
Parsons	14	4 & 5	7	No
Salina	16	5	15-25	Yes
Kentucky:				
Bowling Green	10-15	....	10	Yes
Covington	12	5-8	12	No
Ft. Thomas	10	....	15	Yes
Ludlow	12	10	10	Yes
Louisiana:				
Baton Rouge	12-14	4-6	5	No
Maine:				
Augusta	7½	5-6	24	No
Rockland	8	4	4	No
Maryland:				
Salisbury	10-12	5-7	8-12	Yes
Massachusetts:				
Andover	10	6	2	No
Arlington	15	5	32	Yes
Boston	1/6 width of street		6 or more	Yes
Brockton	10-12	4½-7½	25-30	Yes
Gardner	8	5½	10	No
Greenfield	10-15	4½ & 5	14	Yes
Gt. Barrington	6 & 8	6	....	....
Lee	10-12	6-7	....	Some
Lowell	12	6 & 7	6-20	Yes
Lynn	10	8-9-10	8-12	Yes
Newton	8	5	23	No
Pittsfield	10	5-6	12-15	Yes
Reading	8	5-6	12-15	Some
Southbridge	8	4½	2½	No
Watertown	8-12	6	23-28	Yes
Westfield	10	5	20	No
Worcester	1/6 st. wid.	1/5 st. wid.	....	Yes
Michigan:				
Albion	16	4-6	10	No
Alma	16	5 & 6	20	Yes
Ann Arbor	12 & 14	5 & 6	18	No
Battle Creek	....	4½	6	Yes
Boyne City	6-16	6	16-20	Some
Coldwater	10	5	....	Few
Detroit	Curb to street line	6	10-20	No
Dowagiac	14	5	18	Some
Flint	8-16	5	20	Yes
Greenville	....	4	....	No
Hamtramck	....	6	1	Yes
Hastings	....	4 & 5	12	Yes
Holland	10	6	18-20	No
Iron River	12	6	15 & 25	Yes
Ironwood	10	5	15	No
Lansing	18	6	12	Some
Marquette	10	5' 4"	....	....
Marshall	16	5	9	No
Midland	22	4-5-6	10	Yes
Mt. Pleasant	12	4½	12	Yes
Niles	....	5	12 & 15	No
Owosso	20	4 & 5	12	No
Pontiac	14	5	15-50	Yes
Minnesota:				
Cloquet	10-16	6	20	Some
Duluth	12	5 & 6	20	Yes
Fairmont	16	5' 4"	20	No
Faribault	12	6	15 & 20	No
Hibbing	12	6	12	No
Little Falls	14 & 16	6	20	Yes
Minneapolis	15	6	12	Yes
Montevideo	11	5' 4"	5	....
Owatonna	14	5	....	No
Red Wing	12-14	5	6-20	Yes
Rochester	10-15	5' 4"	10	No
St. Cloud	12-14	6	3-12	Some
Stillwater	10	6	12	Yes
Virginia	14	6	12	No
Willmar	12	4½	10	Yes
Mississippi:				
Biloxi	10	5	10-15	Yes
Clarksdale	10-12-14	4	12 & 16	Yes
Greenwood	12½	5	15	Yes
Hattiesburg	10	5	16	No
Laurel	12½	5	10	No
Yazoo	11	4½	....	....

SIDEWALK DETAILS

State and City	Width of Sidewalk — Pavement — Business Streets	Residence Streets	Radius of Curb Corner Now used	Reconstructing Old Corners?
Missouri:				
Boonville	6-12	4-6	....	Yes
Cape Girardeau	10	5	12 & 15	Soon
Carthage	6-12	4½	20 or more	Yes
Columbia	13	4	30	Yes
Fulton	10	4	10-20	Some
Joplin	10	4½	10-12-15	Yes
Kansas City	12	12	12	Yes
Maplewood	Curb to bldg.	4	13	No
Monett	10 & 12	4 & 5	15	Yes
Nevada	10	5	12	Yes
St. Joseph	12	5	10	Yes
Sedalia	10	4 & 5	10	Expect to
Springfield	10-18	4 & 5	12	Yes
Montana:				
Bozeman	10 & 14	5	4	No
Butte	10	5-8	8	....
Havre	16	5	5½ & 10½	Yes
Helena	8 (variable)	5	15	Yes
Kalispell	12	5 & 6	8	Yes
Livingston	10 & 12	6	8	No
Nebraska:				
Fairbury	14	5	9 & 12	No
Fremont	10-14	4	8	No
Grand Island	15	4, 5 & 6	15	No
Kearney	16	4 & 5	15	Yes
Lincoln	20-25	4	16-20	Some
Norfolk	12 & 16	5	4 & 12	Yes
North Platte	13	4	12	No
New Jersey:				
Bayonne	12	4	12	Yes
Englewood	Curb to bldg.	4	8 & 10	Yes
Hammonton	5-10	4 & 5	10	Yes
Long Branch	12	5	8	No
Newark	Curb to bldg.	5	8-12	Yes
New Brunswick	8-16	5	12	Yes
Newton	12	4 & 5	12-40	Yes
Nutley	10	4	10	No
Orange	10-15	4-5	10, 12 & 15	Some
Passaic	Curb to bldg.	5	12	Yes
Phillipsburg	12	10	10	Yes
Plainfield	12	4	15	Yes
Prospect Park	5 or 6	....	6	Yes
Rahway	15	4-5	6-10	Yes
South Orange	6-15	4-6	Av. 15	Yes
Summit	9-15	4	10-12	Plan to
Trenton	One-fifth width of st.		6-24	Yes
West New York	10-20	6-20	9-10	No
New Mexico:				
Albuquerque	10	6	12	No
Raton	12	5	7½	Yes
Roswell	13	5 & 6	15	Yes
New York:				
Auburn	12-18	4	10-20	Yes
Batavia	15	5	10	No
Corning	12	5	16	Yes
Cortland	10-15	5	15-25	Yes
Dobbs Ferry	8	4	....	No
Endicott	12	5	12	Yes
Geneva	18 & 22	5 & 6	15-35	Yes
Gloversville	6	5	8-10	Yes
Hempstead	Av. 7	4	....	No
Islip	10-12	4-6	8-50	Yes
Ithaca	12	5	15	Yes
Little Falls	11-12	5-6	18	Yes
Lockport	8	4	10	No
Lynbrook	10-15	10	....	Yes
Manhattan Boro. New York	15-20	....	12	Yes
Niagara Falls	Curb to bldg.	5	10	Some
Norwich	20	5	....	....
Ogdensburg	10 & 12	4, 5 & 6	18	No
Oneida	12	5	15 & 20	No
Oneonta	10	5	9	Yes
Perry	6-12	4	....	Yes
Port Jervis	8-10	5	4 & 6	Yes
Rochester	....	5	13	Yes
Saranac Lake	8	5	15	Yes
Tarrytown	10	4-6	10 or more	Some
Troy	14	¼ st width	Sidewalk width	Yes
Watertown	5-24	4	8	No
North Carolina:			Sidewalk width	Few
Asheville	10	....	....	....
Charlotte	7-12	5	15	No
Durham	Curb to bldg.	5	6-100	Yes
Monroe	5	....	6	Yes
Wilmington	12	6	12	No
North Dakota:				
Dickinson	15	4½	9	No
Fargo	Curb to bldg.	4½-6	10-20	No
Jamestown	8 & 16	4½	8	....
Mandan	12	6	15-22	....
Minot	13-18	5	6-18	Yes
Valley City	12	3	3	No
Ohio:				
Akron	Curb. to bldg.	6	15 & up	Yes
Alliance	10-16	5 & 6	10-15	Yes
Ashtabula	14	4 & 5	18-25	Yes
Bellaire	15	10	10, 12 & 15	Yes
Bucyrus	12 & 16	4	10-20	....
Circleville	17½	5	12	Yes

SIDEWALK DETAILS

State and City	Width of Sidewalk — Pavement — Business Streets	Residence Streets	Radius of Curb Corners Now used	Reconstructing Old Corners?
Ohio—(Continued)				
Columbus	15-20	5 & 6	15	Yes
Conneaut	14½	5	10	Yes
Dayton	19	5	8-12	Yes
Delaware	20	5	10	Expect to
E. Youngstown	8	5	8	No
Elyria	10-16	4 & 6	12-30	Yes
Findlay	15	5	10	No
Galion	12	5	20	No
Girard	6	5	10-20	Yes
Hillsboro	10	5	12-20	No
Jackson	14	4 & 5	5, 10 & 12	No
Kent	Curb to bldg.	5	18-25	Yes
Lakewood	12-16	5 & 6	25-30	Yes
Lancaster	15	5 & 6	....	Yes
Lima	....	5 & 4	10	Yes
London	18	4 to 6	4-10	Yes
Lorain	15-20	4	15	Yes
Mansfield	12	5 & 6	16	Yes
Napoleon	12	5	15	No
Newark	18	5	12	Yes
New Philadelphia	12-14	0.1 st. width	12 or more	Yes
New Boston	12	5	6	No
Salem	10	6	6	No
Sandusky	8-16	4-6	20-25	Yes
Urbana	16	5	10	No
Warren	13	5 & 6	....	Yes
Wooster	15	5	20	Some
Zanesville	13	5 & 6	12	Yes
Oklahoma:				
Ada	12	4	20	Some
Ardmore	10 (various)	4	10½	Intend to
Bartlesville	25	5	10-50	Intend to
Blackwell	15	4	15-20	Yes
Henryetta	20	4	25	No
Lawton	10 & 14	4 & 5	15	Yes
Muskogee	12-20	5	10 or more	Yes
Oregon:				
Ashland	10-12	5	4	Few
Astoria	12	5	12	Yes
Eugene	12	5	12	Expect to
Marshfield	12	6	8 & 15	No
Oregon City	10	6	10	Yes
Portland	12	6	12-20	Yes
Salem	14-25	5	10	No
Pennsylvania:				
Altoona	10	5	6-15	Yes
Bangor	8	6	6	No
Berwick	11	5 & 6	5½	No
Bloomsburg	8	5 & 8	4	No
Butler	20	5	15-20	Yes
Chambersburg	11	11	6 & 40	Yes
Clairton	10-12	4-10	10-20	Yes
Clearfield	5-7	5	12-15	Yes
College Hill	10	5	Sidewalk width	Yes
Dowington	10	6	6 & 10	No
Dubois	10	5	12	Yes
Duquesne	8-12	8-10	6 & 10	Yes
Ellwood City	10 & 12	6	6-20	Expect to
Farrell	12	5	10	No
Franklin	12 & 16	4-6	15	Yes
Freeland	8-10	6-8	3 4 & 6	Yes
Greensburg	12	5	4	Some
Hanover	14-18	10-16	7	No
Hazleton	22	6 & 8	2	No
Hollidaysburg	10-12	4-6	6	....
Homestead	14	12	10	Yes
Kingston	6 & 8	5 & 6	10-15	Yes
Lansdowne	6	4	10	Yes
Lebanon	10-13	8-12	5-13	Yes
Luzerne	6	6	6-8	Yes
Mahanoy City	10	4½-10	40 & 80	Yes
Middletown	11	5	4	Yes
Monongahela	11	4½	10	Expect to
Nazareth	10	5 & 6	5 & 10	Yes
New Brighton	15	5	10	Yes
New Castle	⅛ st width	5	⅛ st. width	Yes
Norristown	15	6	10 & 15	Yes
North Braddock	10	8 & 10	8 & 10	Yes
Pittston	10	8	8	Yes
Plymouth	10	5	....	....
Rankin	8-10	8-10	8-10	Yes
Reading	16	13	Sidewalk width	Yes
Reynoldsville	10	5½	....	....
Sayre	Up to 10	4 & 5	10	No
Scottdale	10	4	8	Been done
Scranton	10 & 12	4 & 5	8-12	Yes
Sewickley	10	5 & 6	5	Yes
Sharon	10 & 12	5	15-25	Yes
Shippensburg	8	6	9	No
Slatington	7	6	4 & 8	....
S. Williamsport	5	4	....	....
Steelton	10½	10½	5	Yes
Susquehanna	10	5	....	....
Uniontown	10	6	8	Some
Williamsport	⅛ st. width	.....	Sidewalk width	Yes
Rhode Island:				
Providence	Various	⅛ st width	8 or larger	Yes

SIDEWALK DETAILS

State and City	Width of Sidewalk — Pavement — Business Streets	Residence Streets	Radius of Curb Corner Now used	Reconstructing Old Corners?
South Carolina:				
Chester	8-10	4-5½	8	....
Greenville	6-18	5	6	....
Orangeburg	10 & 12	4 & 5	10-50	Yes
South Dakota:				
Aberdeen	12	....	8	Yes
Madison	10-25	4′ 8″	10-20	No
Mitchell	10	5	7½	Not yet
Sioux Falls	14	5	14 & 16	Some
Watertown	15-18	5	10 & 15	No
Yankton	16	6	12-30	Expect to
Tennessee:				
Clarksville	8	5	Sidewalk width	Yes
Jackson	15	5	10	No
Kingsport	8	....	6	No
Murfreesboro	8	5	10	....
Nashville	9	9-25	9-25	Yes
Union City	10	5	10	No
Texas:				
Alice	15	10	No curbs	....
Brownwood	10	6-10	6-10	No
Cisco	12	4	6-25	Yes
Corsicana	14	4	15 & 20	No
Ennis	16	20	20	Yes
Houston	14	4 or 5	10-20	Yes
Longview	15	4	16	Yes
Palestine	10-15	4-6	10-20	No
Paris	7-15	4	Sidewalk width	Yes
Taylor	15	4	....	....
Weatherford	8	4	....	Yes
Utah:				
Logan	22	5	....	....
Murray	16	4 & 5	2½	No
Salt Lake	20	5 & 6	15	No
Vermont:				
Barre	8-10	5-6	Sidewalk width	No
Newport	10	5	....	....
Virginia:				
Charlottesville	12	5	10 & 15	Yes
Danville	9-12	7-10	6-12	....
Harrisonburg	8-10	5-6	6	Yes
Lynchburg	6-10	4½-6	15	Yes
Petersburg	12	4-6	10	Yes
Salem	8	4½	8-10	Yes
Suffolk	8-14	5	20	Yes
Winchester	10	5	3	Yes
Washington:				
Aberdeen	16	6	10	No
Anacortes	14	6	15	....
Port Angeles	14	5	10	Yes
Raymond	12	5	10	No
Walla Walla	16-20	5 & 6	20	Expect to
Yakima	16	5 & 6	10 or more	Yes
West Virginia:				
Bluefield	8	5	15 or more	Yes
Clarksburg	12	5	10	Yes
Fairmont	10-12	4-6	6-10	No
Wisconsin:				
Antigo	15	5 & 6	4	No
Appleton	16	5	3	No
Baraboo	15	5	....	....
Beloit	12-15	4	20	Yes
Fond du Lac	12-15	5	12	Yes
Green Bay	12-13	5′ 4″	12-35	Yes
Kaukauna	12	5	10	Yes
La Crosse	10-16	6	15	Some
Madison	11-16	5′ 4″	11-30	Yes
Marinette	8	6	10	No
Rice Lake	15	5 & 6	12	....
So. Milwaukee	6	5	10	Yes
Wausau	10-12	6	20	Yes
Wisconsin Rapids	10	5	15	Few
Wyoming:				
Sheridan	16	6	5 & 10	Some

A Floating Road in North Carolina

State Project No. 110 of the North Carolina State Highways, known as the "floating road," has several unusual features. The following facts concerning it are taken from a description in the North Carolina Highway Bulletin by George E. McNutt, resident engineer.

The road lies between Elizabeth City and the Camden County line, a distance of 2.71 miles, most of which is through a swamp. It was originally an old toll road but required reconstruction, and bids were received on May 25, 1922, but on account of the very high bids received they were all rejected and the work was done by the state forces.

The elevation of the land along the entire project was less than one foot above sea-level and the first mile was covered by water at normal tide and would not support a fill because of the softness of the saturated soil. It was decided, therefore, to corduroy this section as a support for the fill, and logs were used approximately 30 feet long, 8 inches thick at the butt and 6 inches thick at the point. A stringer was dowelled to the cross logs about one foot from each end to keep them in place. Difficulty was caused by the fact that the corduroy floated at very high tide. A part of the section had already been corduroyed by the former owner and the old corduroy was used as a foundation.

Meantime a wharf 85x120-feet was being constructed and a derrick erected, as all materials used on the road were to be shipped in by water.

On the corduroy there was placed from 10 inches to 18 inches of fill. There was no material suitable for fill in the vicinity. A small amount of clay found at the extreme eastern end of the project was used at first, but when saturated with the high tide was found to be impassable, and an arrangement was made for 8,000 tons of sand from the banks of the Dismal Swamp canal about 20 miles away. This was unloaded with a derrick and hauled by White trucks to the corduroyed foundation.

On this fill was placed a concrete wearing surface, stone for which was shipped from Havre de Grace, Maryland, and sand from Baltimore. Keeping the forms lined up both horizontally and vertically was difficult on account of the nature of the subgrade. Trucks bringing the concrete aggregate in 3-ton loads caused the subgrade to sink as they passed over it and to rise again after they had passed. Stakes were placed under the forms to hold them in place, but as the grade was wet all the time and the crust over the muck was only 12 inches thick, this did very little good. On account of the soft muck alongside the corduroy, planks had to be provided for the use of laborers in finishing the road as otherwise they would sink deep into the mud.

It had been planned to build the pavement with a 6-inch curb along the sides, but after a little of this had been laid it was discontinued because of the difficulty of keeping the road clean of leaves and trash that were washed on by the high tide. Telephone poles were placed about 4 feet from each side of the pavement and whitewashed about 6 feet high so that traffic could keep on the road during high tide when the pavement was out of sight. The concrete work was finished the end of last May and in November a slight settlement was evident at one point, which was no more than had been expected as the muck under the roadbed is about 20 feet deep and the road is covered by the tide whenever an east or southeast wind blows.